ADMOULD® 3D-F

CADMOULD® 3D-F RAPID

VERSION 6.0

USER MANUAL

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1. Introduction

1.1 Why to simulate an injection moulding process?

The complexity of today's plastic parts as well as the costs, quality and competition pressure makes it necessary to recognize potential errors early, already in the development phase of parts and moulds in order to solve the problems in the design phase. The most flexible, reliable and economical tool for this is the software CADMOULD® 3D-F. It is available today with sufficient efficiency and is meant to support the experienced injection moulding specialist in recognizing and solving problems with the manufacturing process, because simulation is better than trials.

Very often the location of air traps and weld lines is an important topic. With the injection moulding simulation you can optimally define the points of injection or change the wall thickness before the actual injection moulding process in order to shift the location of the weld lines into uncritical areas. You can avoid air traps. The simulation enables you to optimize the process parameters. It quickly supplies you with results for cost reduction of your products.

1.2 What can CADMOULD® 3D-F RAPID do?

CADMOULD® 3D-F stands for patented technology (EP 1 385 5103).
The special 3D-framework (3D-F) crosslinking method has the advantage, that the 3D-F mesh, which is needed for simulation, is generated automatically. Please see the appendix for more information.
Technical explanation of the CADMOULD® 3D-F method

CADMOULD® 3D-F RAPID is a “Computer Aided Engineering (CAE)” software. It is able to simulate the filling phase of the injection moulding process depending on the assigned thermoplastic material and process parameters. As most important results the filling pattern, the pressure loss and the remaining cooling time.

Thus different conditions and suppositions can be compared very easily. Furthermore you are endued with important information like temperature, shear stress, clamping force, weld lines, air traps and process parameter.

In order to run a simulation, it is necessary to describe the part geometry. Normally the part geometry is available from the CAD system. The CAD format, which is utilized by CADMOULD® 3D-F RAPID, is the so called STL-format (stereo lithography - format). This data format can also originate from a 3rd party conversion program.
CADMOULD® 3D-F RAPID reads the STL- File and provides automatically a model for the simulation of the part. Gate locations can easily be defined. The material database distributed with the program can be edited and extended.

On this CD-ROM you find also the stand alone program CADMOULD® 3D-F VIEWER:
CADMOULD® 3D-F VIEWER is a program to present all possible results of a CADMOULD® 3D-F calculation.
This software has to be installed separately. To do this, please start the setup in the subfolder "CMViewer" on this CD-ROM.
Please contact your distributor in case of questions about the license.

On the product information CD you find the CADMOULD® 3D-F Viewlets. This are animated product descriptions, which comes near to a short beginner tutorial.

1.3 How exact calculates CADMOULD® 3D-F?

By own benchmarking from ***sim**con* in national and international public founded research projects, as well as by CADMOULD® 3D-F users is guaranteed, that CADMOULD® 3D-F RAPID can provide very exact results.
The results of the simulation with non-reinforced as well as fibre-reinforced material are in the range of the process variation and measuring tolerance.

2. Installation

2.1 Software requirements

Windows® XP/Vista (32bit, 64bit), Windows® 2000, MS-EXCEL® (from Office 97), Browser MS-Internetexplorer or Firefox, Acrobat Reader (V9.0 contained on CD)

2.2 Hardware requirements

fast CPU, option: multi core CPU, min. 1 GB RAM, min 50 GB free hard disk space, graphic adapter with OpenGL support, USB 2.0 port, 3 button mouse, option: SpaceNavigator®, CD-ROM or DVD-ROM

2.3 Before the installation

CADMOULD® 3D-F RAPID can be installed by an administrator only.
CADMOULD® 3D-F RAPID is delivered on CD-ROM. The license file will be sent by e-mail.

To install the USB Dongle:

Please, attach the provided dongle to a USB port on your computer. Regard, that the red LED on the dongle lights. In some cases it is possible, that the dongle is not recognized, then please try another USB port.

2.4 Installation

To install please insert the CD ROM into your CD-ROM drive. The installation procedure should start automatically after a short time. If the installation procedure does not begin, start the routine by hand:

1) Open the Windows-Explorer.
2) Change to the CD-ROM and open the root directory.
3) Start the installation program »Starter(.exe)«

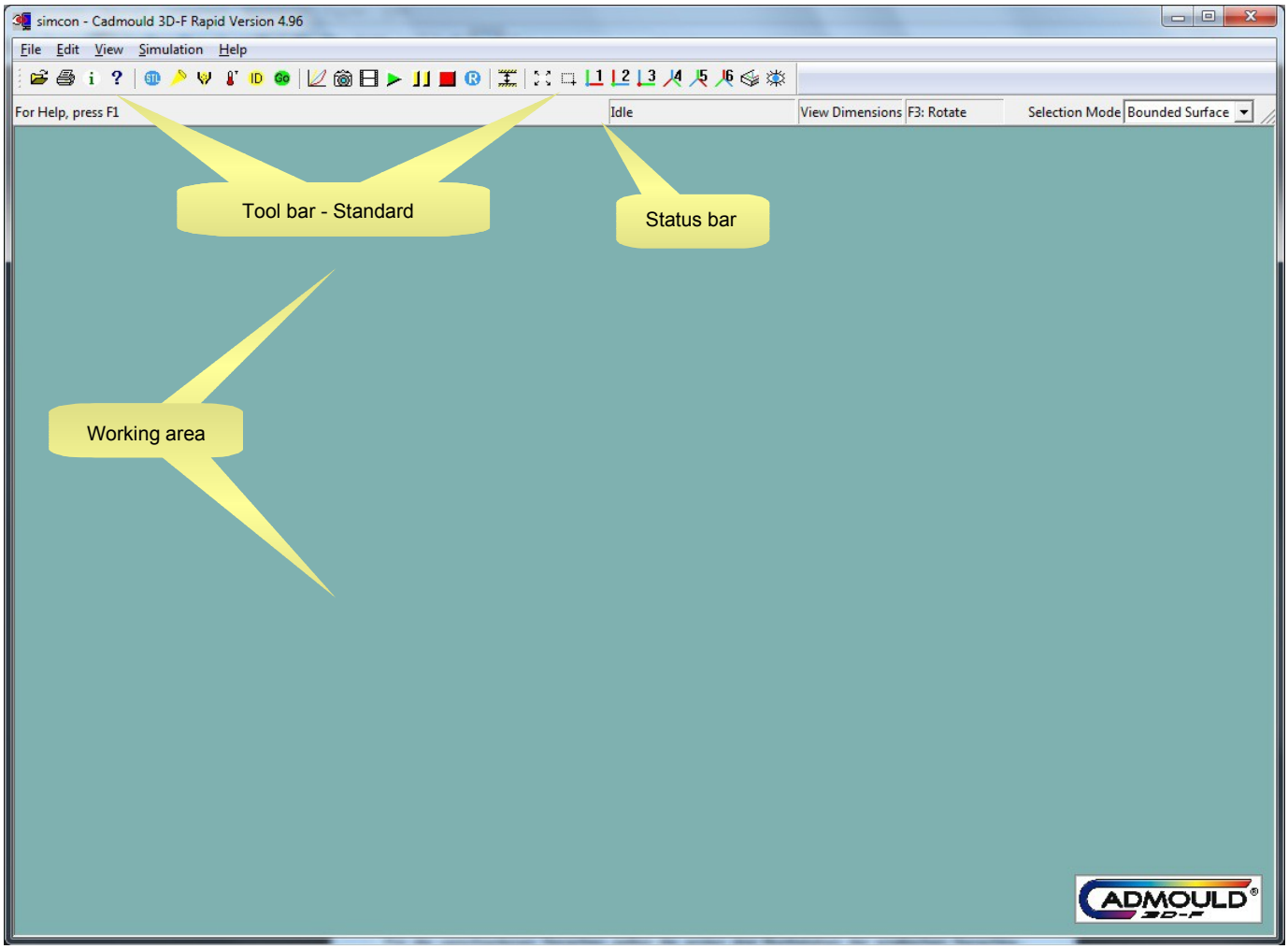
- installation directory
  The directory, where the software is to be installed. The standard is »C:\Program files\Cadmould\Rapid«. For reasons of uniformity the program system should be installed into the given directory.

4) Indicate the location of the license file.
- This is the directory where you saved the license file from the mail.

3. Starting CADMOULD® 3D-F RAPID

You can start CADMOULD® 3D-F RAPID by double-clicking on the icon on your desktop, if this was created during the installation procedure, or you start it by: "Start ⇒ Programs ⇒ Cadmould ⇒ 3D-F Rapid ⇒ CADMOULD® 3D-F RAPID ".

Thus you receive the following "start" window:



Please look up specific menus and buttons in the topics "**Menu Bar**" resp. "**Button Bar**".

3.1 Command Line Options

The command line options allow to start CADMOULD® 3D-F with user-specific settings. These options are suffixed to the <Cadmould.exe> on the register attributes of the desktop icon. The following options are available among others:

3.1.1 Program language

With the command "-lng language" you can define the language which is used at the start of CADMOULD® 3D-F.

The different languages are abbreviated by the first three characters of the language name.

e.g.: eng; ger; fre; ita; spa; por;

3.1.2 Full Screen

If you add the command "-fsc", CADMOULD® 3D-F is started in full screen mode.

3.2 3D Display with stereo projection

You now have the possibility to display the part stereoscopically.

To use this function you need the following hardware which supports this:

- a graphics card with quad buffering, e.g. nVIDIA Quadro
- shutter glasses
- a display or projector with a frequency of at least 120 Hz

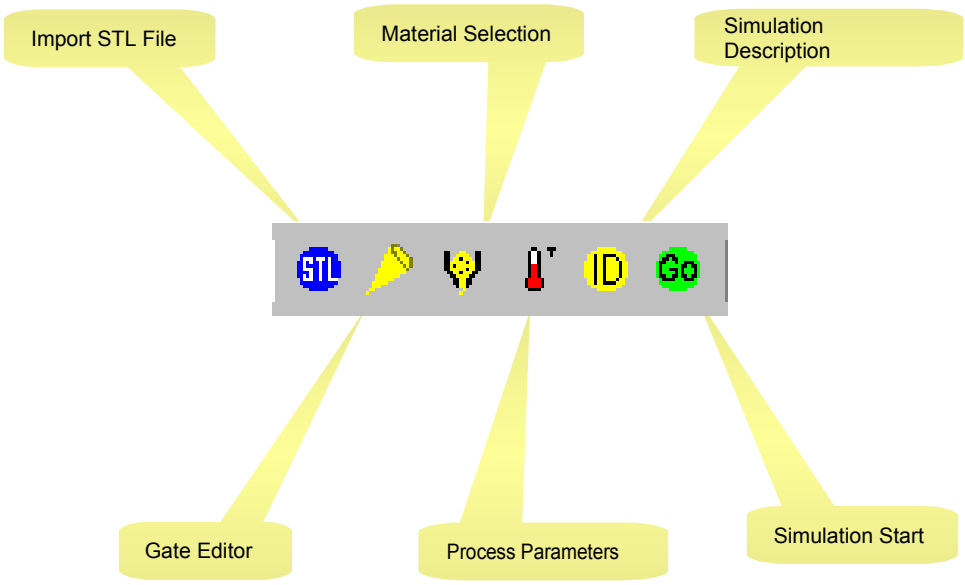
If you want to use this function, you have to start Cadmould 3D-F with the command line option “-prm 2”. You cannot switch between orthogonal and stereoscopic view while the program is running.

Therefore it is advisable to create two desktop icons, one with the command line option “-prm 2” to start the program in stereoscopic mode and one without these option to start it normally.

Please see also chapter: 11.3.13.6 Perspective/Stereo

4. Carrying out a simulation

Perform a simulation by filling in the menus appearing after clicking the buttons from left to the right.



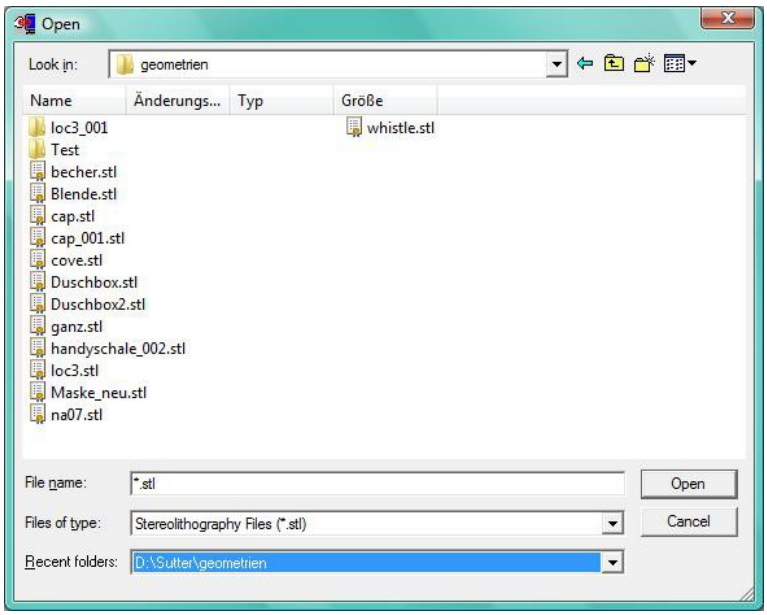
4.1 Load a geometry

(*See* chapter*:* **Appendix, STL file**)

(1) Click on the icon "Import STL File".

⇒ The window "Open" appears on screen.

(2) Browse to the directory with the STL-file (stereo lithography file) describing your part geometry. (Four example geometries are shipped with the software. You find them in the subdirectory geom in the installation path.)



(3) Click on the file:

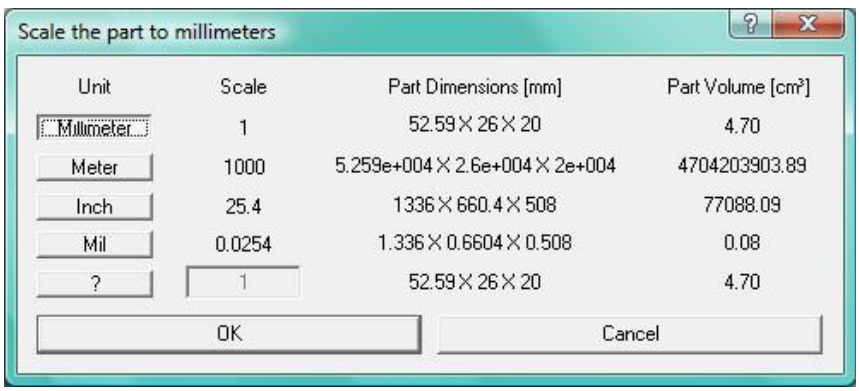
Example: File name: whistle.stl

(4) Click on "Open".

(5) Wait for the geometry to load and appear on the screen.

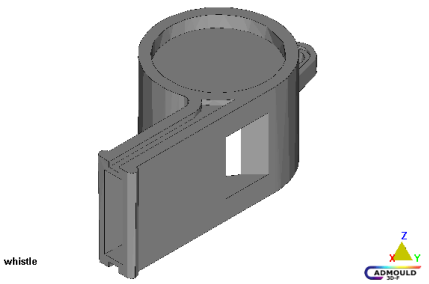
⇒ The window "Scale the part to millimeters" appears.

(6) Compare the size of the bounding box of your part with the units given on the left side in this window. Click the unit which gives the right size of your part and then "OK", or scale the part to your needs in the scale window "?" and then click “OK”.



Note: If an STL-file contains more than one part, a message will appear "n parts extracted from "rubbish.stl"!". If the user declines this as an error (in the stl), he can show or hide the objects with the object list on the card "Visibility" in the dialog "View Options" With the dialog "Delete" he can delete erroneous parts easily.

Example: Whistle



4.2 Define a gate location

(1) Click on the icon "Gate Editor".

(2) Wait until the window "Gate Locations" appears on the screen.

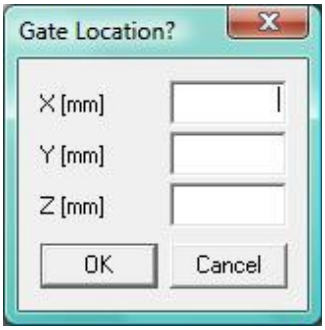
(3) Now you can define the gate locations:

a) by a mouse-click

b) by keyboard

a) by a mouse-click

Keep the <Ctrl> key pressed and click the location on the part where you want to gate it. The coordinates of the gate will be indicated in the window "Gate Locations".



b) by keyboard

(1) Click "Add".

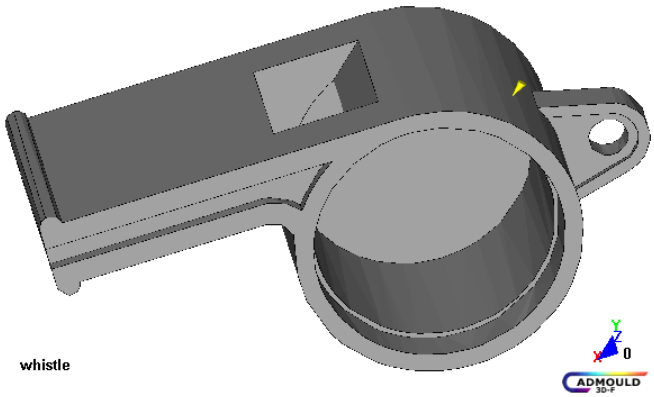
(2) Wait, until the window "Edit Gate Locations" appears on the screen.

(3) Indicate the coordinates as x, y, z components.

⇒ If the indicated point does not fit to the part surface, the desired gate location will be projected onto the part surface in view direction.

(4) Click "OK".

Example: Whistle with one gate



Note: If you know two of three coordinates, you can leave the third coordinate empty. CADMOULD® 3D-F will find it by itself.

You just have to put in a + or –, to define the direction from which CADMOULD® 3D-F has to drop a perpendicular onto the part surface. Eg: (14.5, 0, +) The input '+' will let the program drop a perpendicular from the point (14.5, 0, Zmax) in negative Z-direction from above down onto the part. If you want to define the gate on the bottom, you put (14.5, 0, -) in, without rotating the part (which was necessary in earlier versions, because the projection of points in viewing direction could find only visible points). Then the program will drop a perpendicular from the point (14.5, 0, Zmin) in positive Z-direction from below up onto the part.

Point on ... function

The “Point on...” function is from now on located in the status bar of CADMOULD® 3D-F.
This function helps you to select a point on the surface of the part. The pull-down menu is only visible, if a selection of a point is necessary.

- Activate the option „Surface“, keep the button <Ctrl> pressed and click on a surface, in order to select one point on the surface.
- Activate the option „Edge“, keep the button <Ctrl> pressed and click near to an edge, in order to select one point on the Edge.
- Activate the option „Corner“, keep the button <Ctrl> pressed and click near to a corner, in order to select the corner on the surface.
- Activate the option „Node“, keep the button <Ctrl> pressed and click near to a node, in order to select one node on the surface.

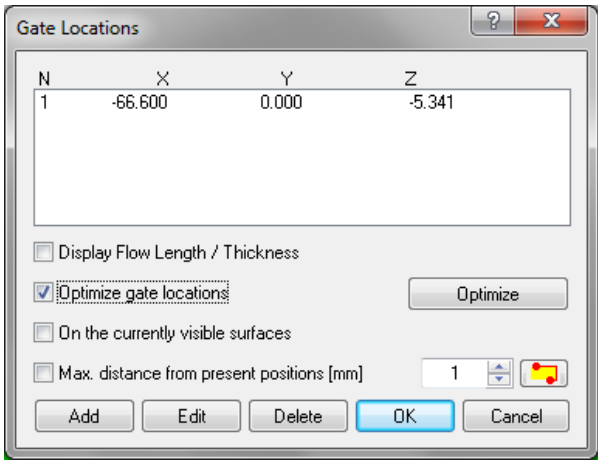
4.2.1 Edit

(1) Mark the coordinates by clicking them.
(2) Click "Edit".
(3) Wait until the window "Edit Gate Location" appears on the screen.
(4) Enter modified coordinates.
(5) Click "OK".

4.2.2 Delete

(1) Mark the coordinates by clicking them.
(2) Click "Delete".

4.2.3 Optimizing the gate locations



CADMOULD® 3D-F provides you with the possibility, to optimize the gate locations chosen by you.

Therefore, you have to activate the option <Optimize gate locations> in the window <Gate locations>.

The option <Permit crossing of the part> means, that CADMOULD® 3D-F involves the oposite side of the part also. This could be helpful, if you want to gate at a root of fin and does not matter, on which side the gate is set.

The next step is choosing your options and then cklick <Optimize> to start the gate optimization.

If you agree to the new locations click <Ok>, otherwise click <Undo> to restore the old locations.

Note: The optimization can only be run, if the mesh of the part is already prepared.

4.2.4 Display Flow Length / Thickness

The function <Display Flow Length / Thickness> helps you to define the number of gates and their positions. To use this function, you need a prepared mesh.

4.3 Select a material

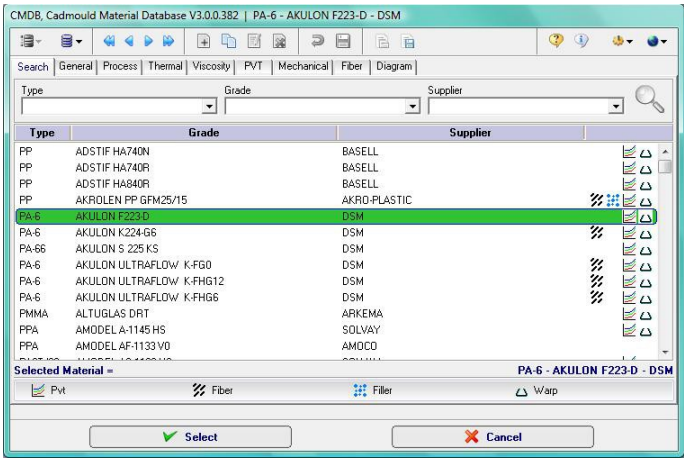
(1) Click "Material Selection".

⇒ The window "CADMOULD® 3D-F material database" appears on the screen.

(2) Find the material you want to use.

(3) Mark the desired material by clicking.

(4) Click "Select", if you marked the correct material.

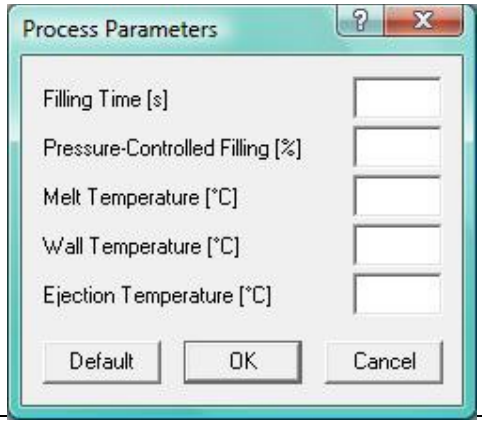


4.4 Define the process conditions

(1) Click "Process Parameters".

⇒ The window "Process Parameters" appears on the screen.

(2) Define the Filling Time, the Switch-to-Packing Level, the Melt Temperature, the Wall Temperature and the Ejection Temperature,



or

click "Default", if you like to use proposed values for the selected material.

(3) Change the values, if you do not want to accept them.

(4) Click "OK", if you accept the modified parameters.

4.5 Describe and store the simulation.

(1) Click "Simulation Description" (ID button).

⇒ The window "Simulation Description" appears on the screen.

(2) Check the path and the directory, in which the results will be stored.

a) if you want to accept the path:

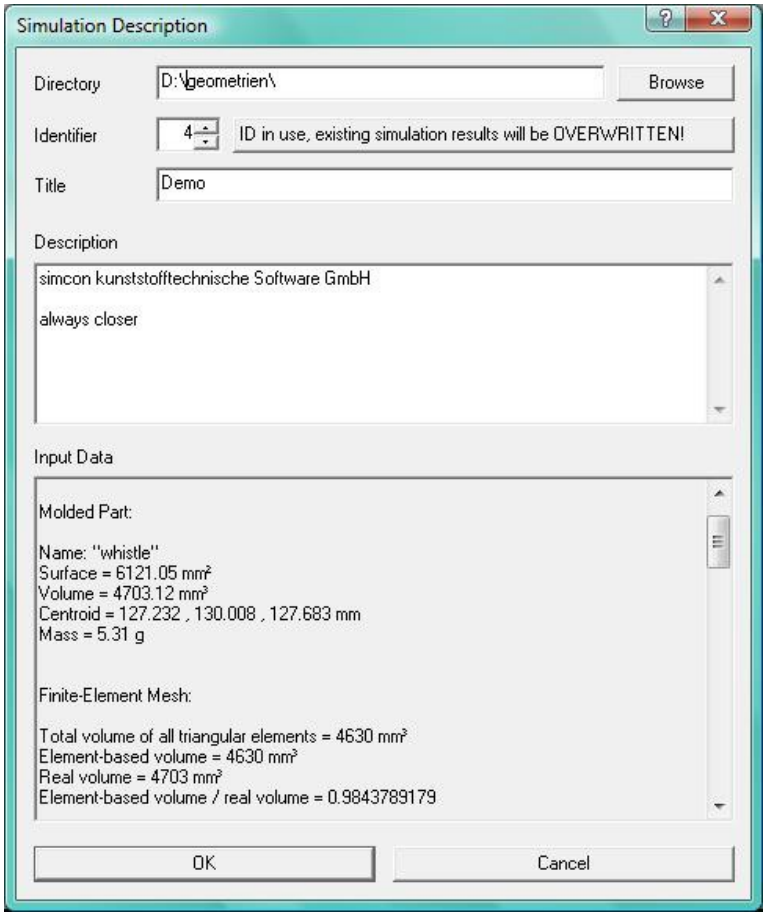
⇒ Go on with point (3).

b) If not:

1. Click "Browse".

⇒ The window: "Save as" appears on the screen.

2. Set the path and the directory.
3. Click "Save".



(3) Chose an identification number in the field "Result Identifier". (Usually simulations are given ascending ID numbers)

Example:

Result Identifier: 4

(4) Enter a name for the simulation run in the field "Title". This will appear with the results.

Example:

Title: Demo CADMOULD® 3D-F

(5) (optional) Describe the simulation process in the field "Description". This is stored to a text file for later access.

(6) Click "OK".

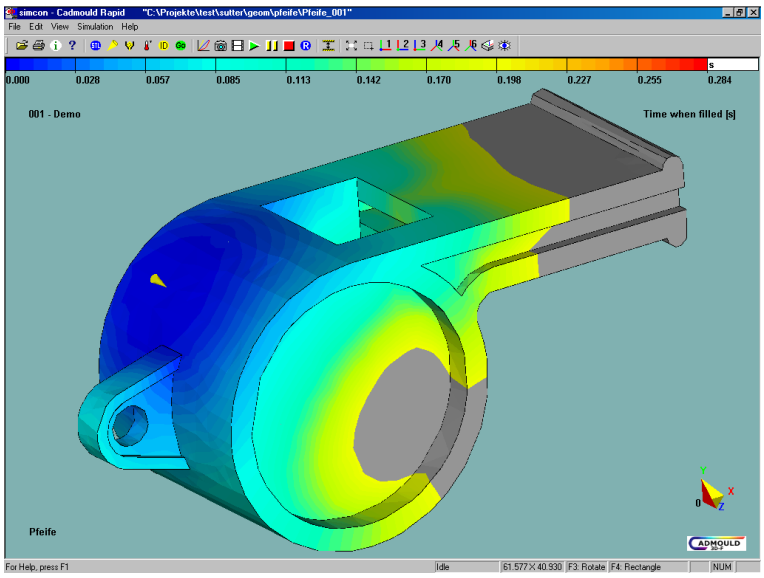
4.6 Start the simulation

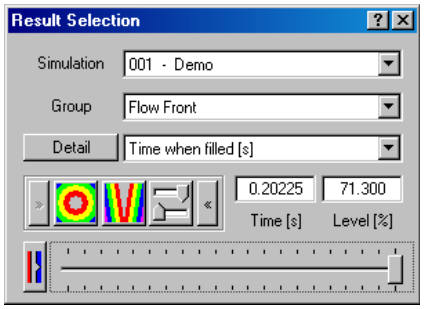
Before you start the simulation, please consider the chapter:

"Options"

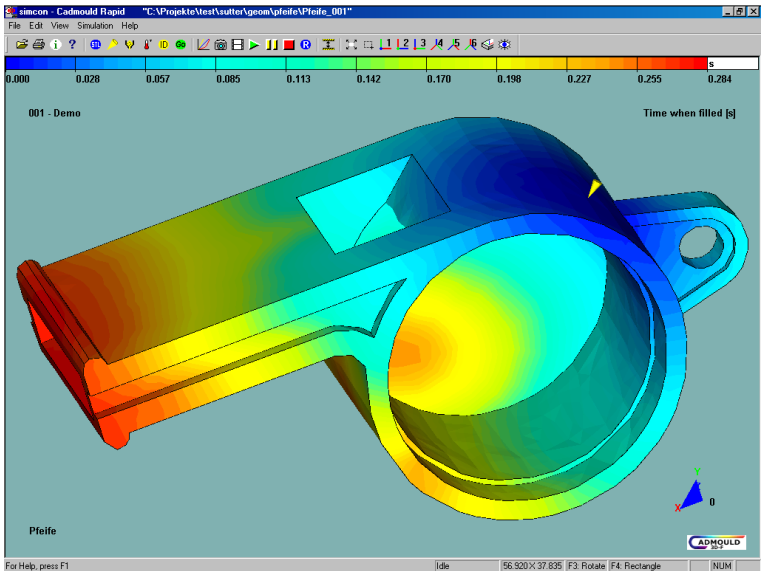
(1) Click "Simulation Start" (Go button).

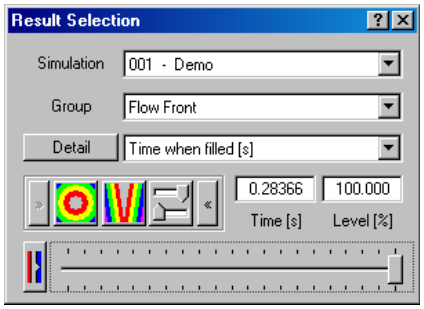
(2) Wait, until you get a message that the simulation is finished.





During the simulation the display shows the properties at the current filling level. Information about the result detail displayed and the state of the filling are given in the “Result Selection” pop-up. The result detail may be switched to any other currently available detail.



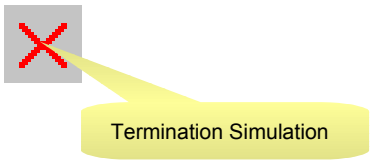


When the simulation is finished, the diagram shows the part with the properties at 100% filling. That corresponds with a filling time of 0.28366s.

4.7 Cancel the simulation

A currently running simulation can be canceled.

After the start of a computation the button "**Start Simulation**" is turns into the new button "**Termination Simulation**".



If you click it, the calculation is canceled at the next possible time, but earliest after the end of preparing the CFE - mesh.

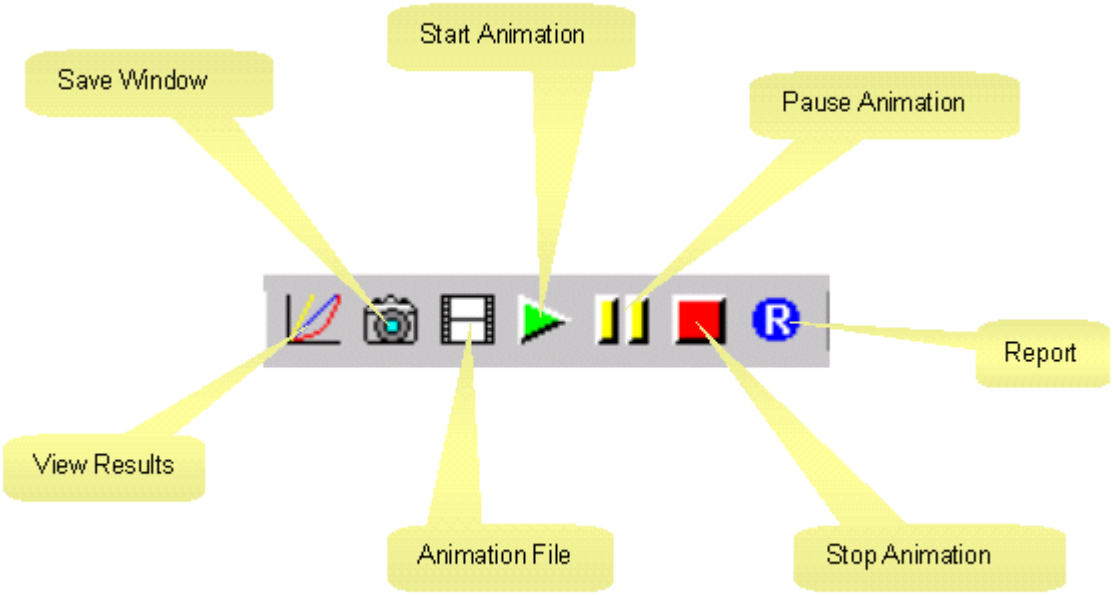
4.8 Stored Results

All simulation results were stored automatically in files with extensions .RM1 and .CAR in the directory you indicated or confirmed when entering the ID.

(*See* chapter: **"Description"**)

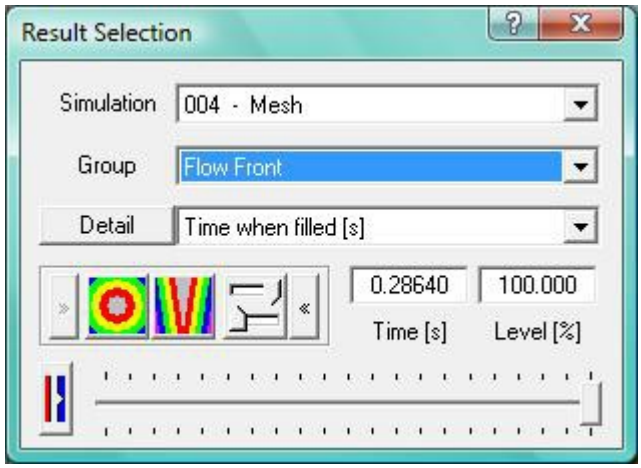
5. Result selection

Results can be viewed and documented in several ways.



Click "View Results".

⇒ The window "Result Selection" appears on the screen.



Different *Result Groups* are available.

In each group there are several *Result Details*.

Visible results can be varied and additional information can be displayed using the controls below these selection fields.

5.1 Result groups

The following result groups are available:

- Cavity
- Flow Front
- Snapshot Filling
- Filling Temperature (interior)
- Part Quality

Result files can be converted into text files.

(*See* chapter: **Convert / CAR ->Txt**)

5.2 Result details

Mind that depending on licensing and material properties available, the offered choice of result details may vary.

Cavity:	Part without results
Flow Front:	Time When Filled [s] Level When Filled [%] Filled by Gate Temperature When Filled [°C] Pressure Loss [bar] Shear Stress When Filled [kPa] Velocity When Filled [mm/s]
Snapshot Filling:	Temperature [°C] Pressure [bar] Shear Stress [kPa] Velocity [mm/s] Frozen Layer Thickness [%] Free Cross Section [mm] Volume Shrinkage [%]
Filling Temperature (Interior):	Layer projected on the part
Part Quality:	Filling Problems Sinkmarks Ejection Time [s]

Explication of the content of the result details you find in chapter: **Description of results**

Note: Hitting the button “Detail”, information pops up. Eg: "Pressure [bar]" is the new default result detail of result group "Snapshot Filling."
The standard result detail is a user preference and will be saved in the registry. If there is no entry, the first result column of the result group will be shown.

5.3 Interior results

In CADMOULD® 3D-F you can see the temperature results from the inside of the part at the end of the filling phase.

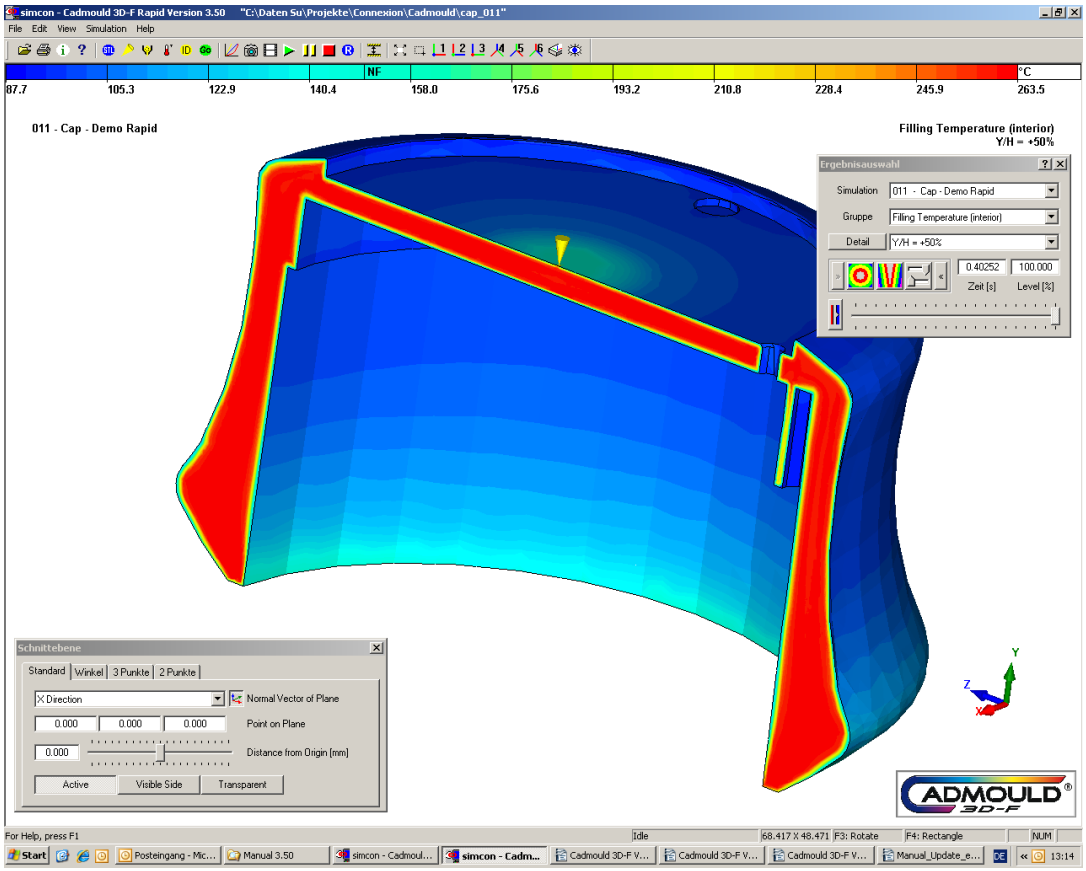
5.3.1 Display of interior results

After executing a simulation you can now regard the interior results.

Open the result selection and select the group “Filling Temperature (interior)”.

Open the function “Cutting Plane” (Menu bar → View → Cutaway).

Activate now the cut by selecting a cutting direction and pushing the button “Active”.



5.4 3D Flow front

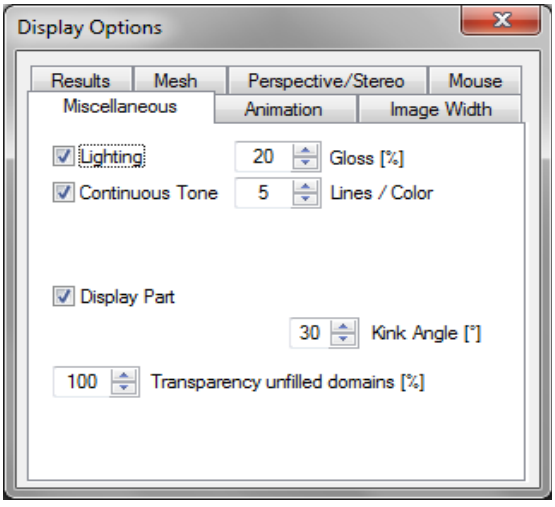
The latest version of Cadmould 3D-F gives you the possibility to see a 3D flow front.

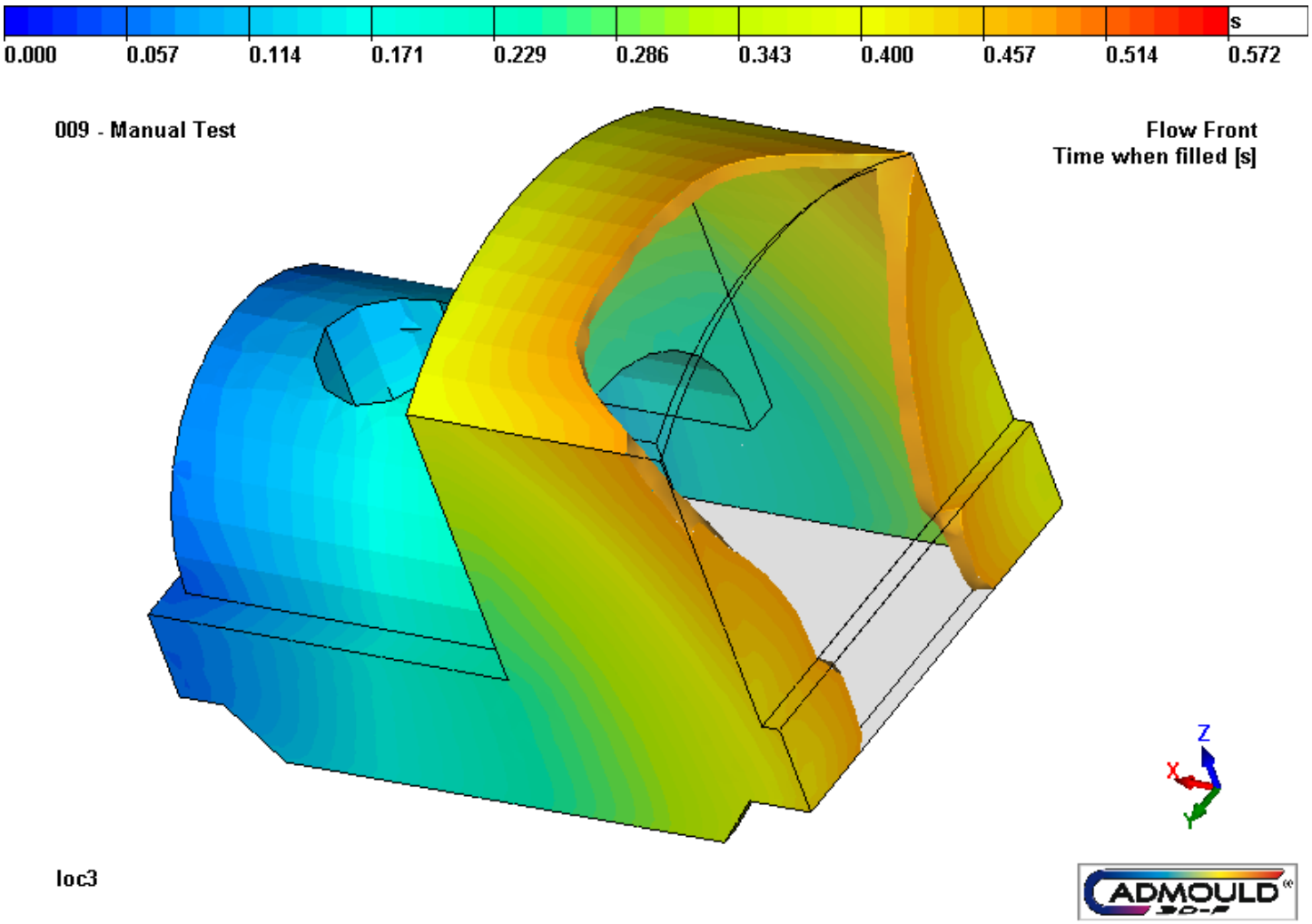
5.4.1 Activate the display of the 3D flow front

Open the menu “View – Options – Miscellaneous”.

In the option “Transparency unfilled domains” choose a value smaller than 100%. A value about 25% is advisable.

Now display one of the results “Time when filled” or “Level when filled” from the result window and you get a 3D flow front when you move the flow front by slider or by entering a point in time.

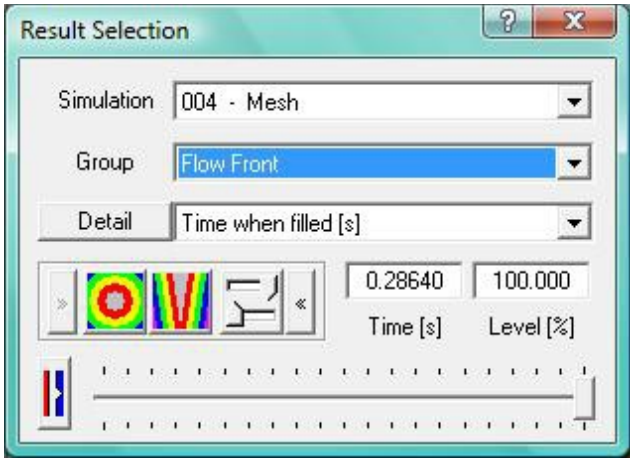




Example of a 3D flowfront.

5.5 Evaluation of multiple results

If you have run several simulations for a part, you can select the simulation results in the window "Result Selection" under the title: "*Simulation*".



(1) Click the arrow in the line: *Simulation*.
(2) Select a simulation by clicking it.

5.6 Loading New Results

If you want to open a different part with already existing results, click "Open" in the pull down menu "File", or click on the first button in the toolbar.
(*See* chapter: **"Open"**)

6. Description of results

6.1 Cavity

The geometry of your part without any result.

6.2 Flow Front

In <Time When Filled> and <Level When Filled> the filling pattern (isochrones) is stored.
In <Time When Filled> the time is stored, at which each point is reached by the flow front.
In <Level When Filled> the filling levels is stored, at which each point is reached by the flow front.
Both filling patterns may be scaled using the slider and also may be animated.

In the ISO-Picture <Filled by Gate> you can see the influence of the different gates. The melt of each gate will be displayed in an own color.
In case of using cascade filling it is process conditional possible that the filling operation of following gates is unrealized.

<Temperature When Filled [°C]> holds the temperature of the melt at the time of each point being reached by the melt front, i.e. here the flow front temperatures are stored. The displayed temperatures are average values across the part's thickness.

<Pressure Loss [bar]> indicates the pressure loss from the point of injection to the respective place at the time of 100 % filling (the maximum if more than one injection point was defined.).

<Shear Stress When Filled [kPa]> contains the shear stress at the flow front. The maximum shear stress over the thickness usually occurring close to the wall or the frozen skin is given.

<Velocity When Filled [mm/s]> represents the flow front speed, when the flow front reaches the location you are looking at.

6.3 Snapshot Filling

The category <Snapshot Filling> contains snapshots, i.e. here values at specific times during filling are stored. The time can be set by the slide control in the result menu. In addition the results can be animated.

The following results are available:

<Temperature [°C]>:
The average temperature across the parts thickness (wall to wall).

<Pressure [bar]>:

The current pressure at each location of the part.

<Shear Stress [kPa]>:

The maximum shear stress across the thickness at each location of the part.

<Velocity [mm/s]>:

The average velocity across the parts thickness.

<Frozen Layer Thickness [%]>:

The thickness of the frozen layer as percentage of the parts thickness.

<Free X Section [mm]>:

The thickness of the flowable layer.

6.4 Part Quality

Points which are difficult to fill can be recognized with the result <Filling Problems>.

There are four categories:

green = good to fill

yellow = problems with the filling are likely

red = there are problems with the filling

white = not filled

Criteria are comparison of flow front and melt temperature as well as comparison of filling time and sealing time.

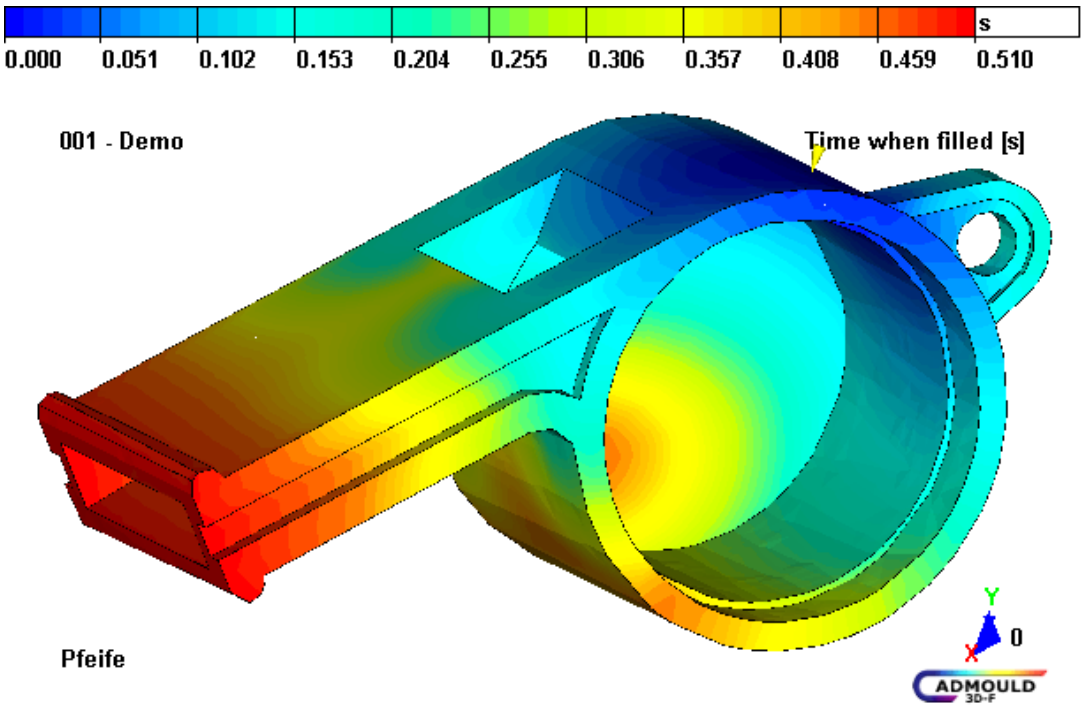
For the analysis of <Sink Marks> the sealing time is compared with the time of freezing.

The <Ejection Time [s]> is the time when the **average** temperature reaches the ejection temperature.

7. Examples of the results

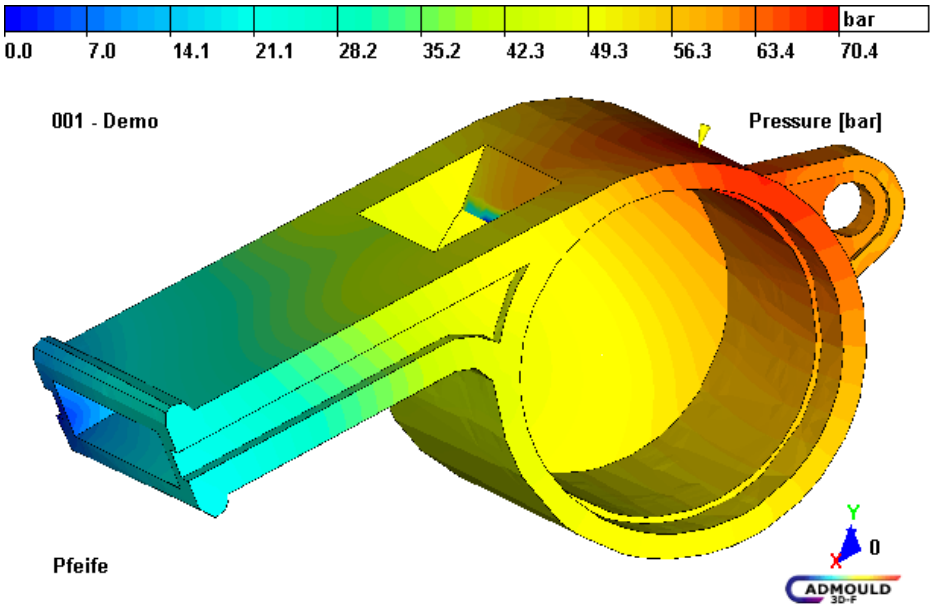
You find the result: "Time When Filled" in the result category "Flow Front“. This result shows isochrones of the flow fronts during filling. Each color is assigned to an equal long time range depending on the number of colors in the scale.

e.g.: the color blue is assigned to the time range 0.000 – 0.051s, the time 0.5s is shown in the last red color that encloses 0.459 – 0.510s.

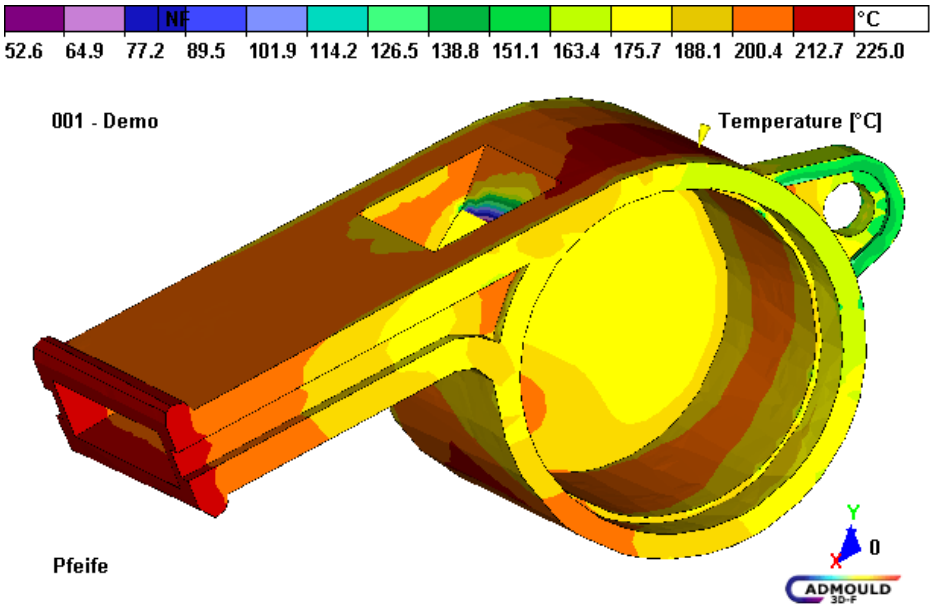


You can detect potential problems due to weld lines or air traps in this presentation.

This picture shows the current pressure at each point of the part.

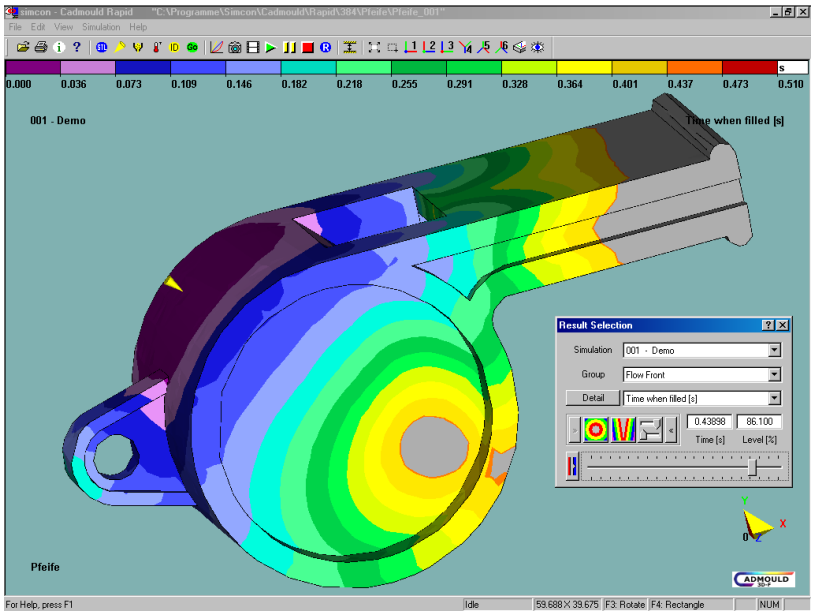


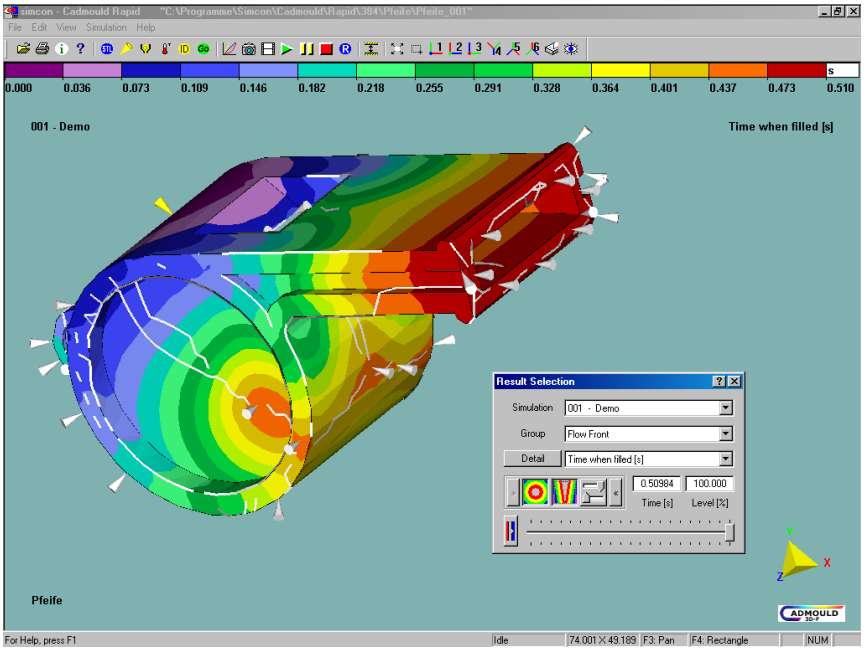
This picture shows the temperature at the end of the filling phase for each place / point at the part. (Color scale set to 14 colors for better reading)



The result shows an air trap at the round wall. An air trap can lead to the so-called “Diesel effect” and burn the material. Obviously, the flow front is slower in the round wall than the flow front in the cylinder wall, this is the reason for the air trap. In order to increase the flow front speed in the round wall, the wall thickness is changed.

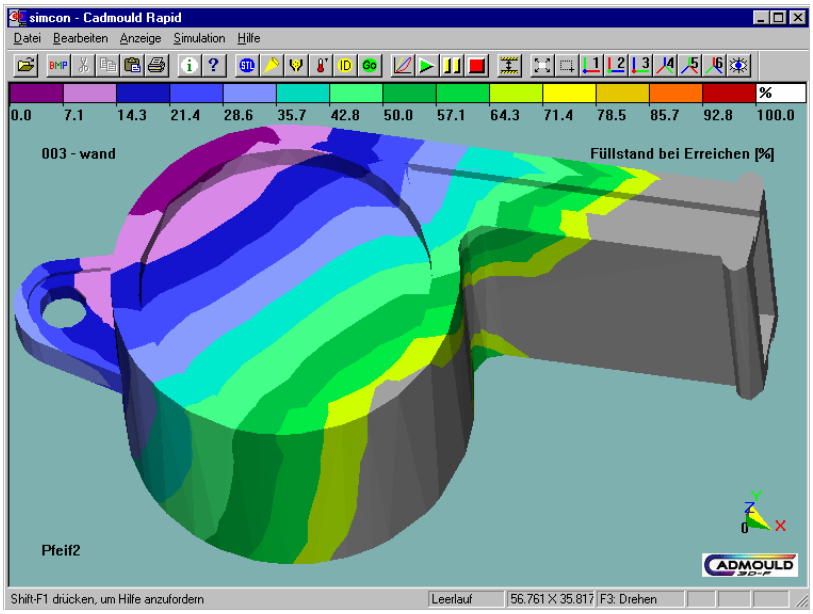
(*See* chapter: **“Thickness”**)





The air traps and weld lines can be indicated.

The next picture shows the result of a simulation, after the wall thickness was changed from 1 to 1.5 mm. The air trap at the round wall is avoided.


simcon - Cadmould Rapid
Datei Bearbeiten Anzeige Simulation Hilfe
0.0 7.1 14.3 21.4 28.6 35.7 42.8 50.0 57.1 64.3 71.4 78.5 85.7 92.8 100.0
%
003 - wand
Füllstand bei Erreichen [%]
Pfeif2
Shift-F1 drücken, um Hilfe anzufordern
Leerlauf
56.761 X 35.817
F3: Drehen

8. Animations

8.1 Online Animations

You can animate all results in the categories: "Snapshot Filling", "Snapshot Packing" and the results: "Time When Filled" and "Level When Filled" in the category "Flow Front".
(*see* chapter: **"Description of results"**)

For playing an animation use the keys "**Play**", "**Pause**" and "**Stop**" or use the button in the menu bar.
(*see* chapter: "Results")

Before you play an animation consider please the chapter:
"Results, Animation Frames",

8.2 Single-Step Frames

In the window "Result Selection" you can look at single results in each stage of the injection molding process. You can determine the time and the filling level by keyboard or mouse.

⇒ by keyboard

♦ define the time

(1) Mark the field "Time [s]".
(2) Enter a time value.
(3) Press "Return".

♦ define the filling level

(1) Mark the field "Level [%]".
(2) Enter the filling level between 0 - 100.
(3) Press "Return".

⇒ adjust the slider

♦ by mouse

(1) Drag the slider. Resting for a short period will let the display adjust to the time position.

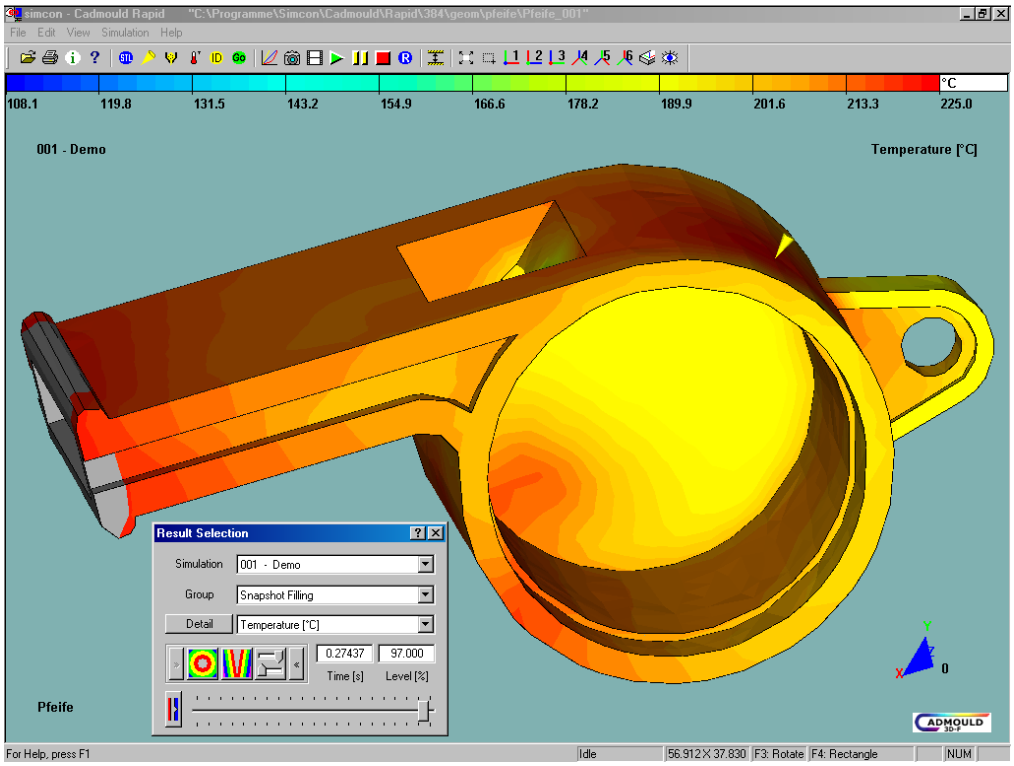
♦ by keyboard

(1) Position the cursor on the slider

(2) Shift the slider using the ←/→ keys.

Example: 1

Picture shows the average temperature at a filling level of 97%.



8.3 Store Animations

You can store every animation as an avi-file. You can insert these into your reports, presentations etc. and run it with the appropriate software, e.g. Microsoft's Media Player. It is not possible to view the stored animations with CADMOULD® 3D-F.

Alternatively you can store the animation as a sequence of pictures in the .PNG or .BMP file format. Therefore choose one of those file formats in the list "Save as type".
As result you get a sequence of pictures like the following example:

"Movie_00000000.bmp"
"Movie_00000001.bmp"
"Movie_00000002.bmp"
...

You can make an avi-file from this pictures with the function "File -> BMP/PNG -> AVI". Every picture will be shown for the same time in the animation. Please see chapter: BMP/PNG -> AVI

Before storing a film please consider the chapter: Animation.

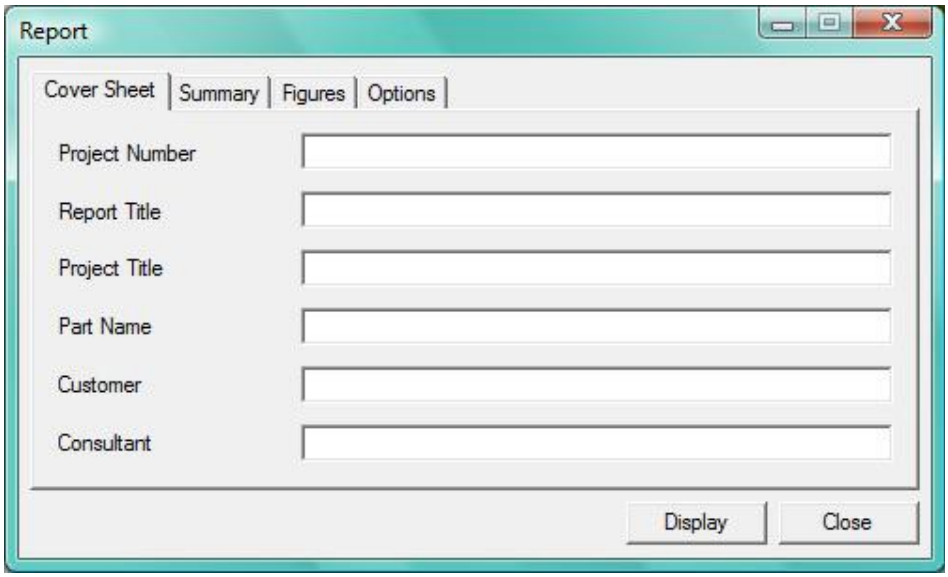
1) Select a result an animation can be run on.
2) Click "Animation File".
   ⇒ The window "Save as" appears on the screen.
3) Give the path, the directory and a name for the file.
4) Click "Save".

9. Report Filling Analysis

A user defined report of your filling simulations can be generated automatically by the function “report”. You can print this file or send it as an e-mail.

(1) Click “Report”.

⇒ The window “Report” appears on the screen.



(2) Enter your project data in the template "Cover Sheet" completely.

(3) In the template "Summary" add a short summary to the report.

(4) Click “Default” in the template "Figures".

(See the following chapter: **"**Save Image**"**, if you have not specified a standard report yet.)

⇒ The window "Open" appears on the screen.

Several RIL-files are in the directory where you have installed CADMOULD® 3D-F. Each RIL-file stands for a language e.g. ger.ril stands for German, eng.ril for English, ther-ger.ril for thermoplastic – German, elas-ger.ril for rubber - German.

(5) Open the RIL-file of your choice. All figures defined therein are generated automatically. The current aspect of your part will be applied, so set this before you select the report file.

(6) Determine the form of your report and its administration in the submenu "Options".

Appearance: Mark how to proceed with the legend of the figures. The legend is a set of information about the type of result and the process that the program generates automatically. It can be controlled depending on the presence of your caption.

Mark "General Remarks" to integrated these into the report. General remark may be helpful for people not so familiar in interpreting simulation results. They also give some guidelines how to improve possible defects.

Administration: By creating a report a subdirectory is created where all files belonging to the report files are stored. The report itself can be stored in a separate directory.

Mark whether you would like to store the report in a subdirectory or in the report-specific directory.

The report-specific directory can be selected with the browser or be created manually by indicating a new path,

e.g. D:\Reports\John

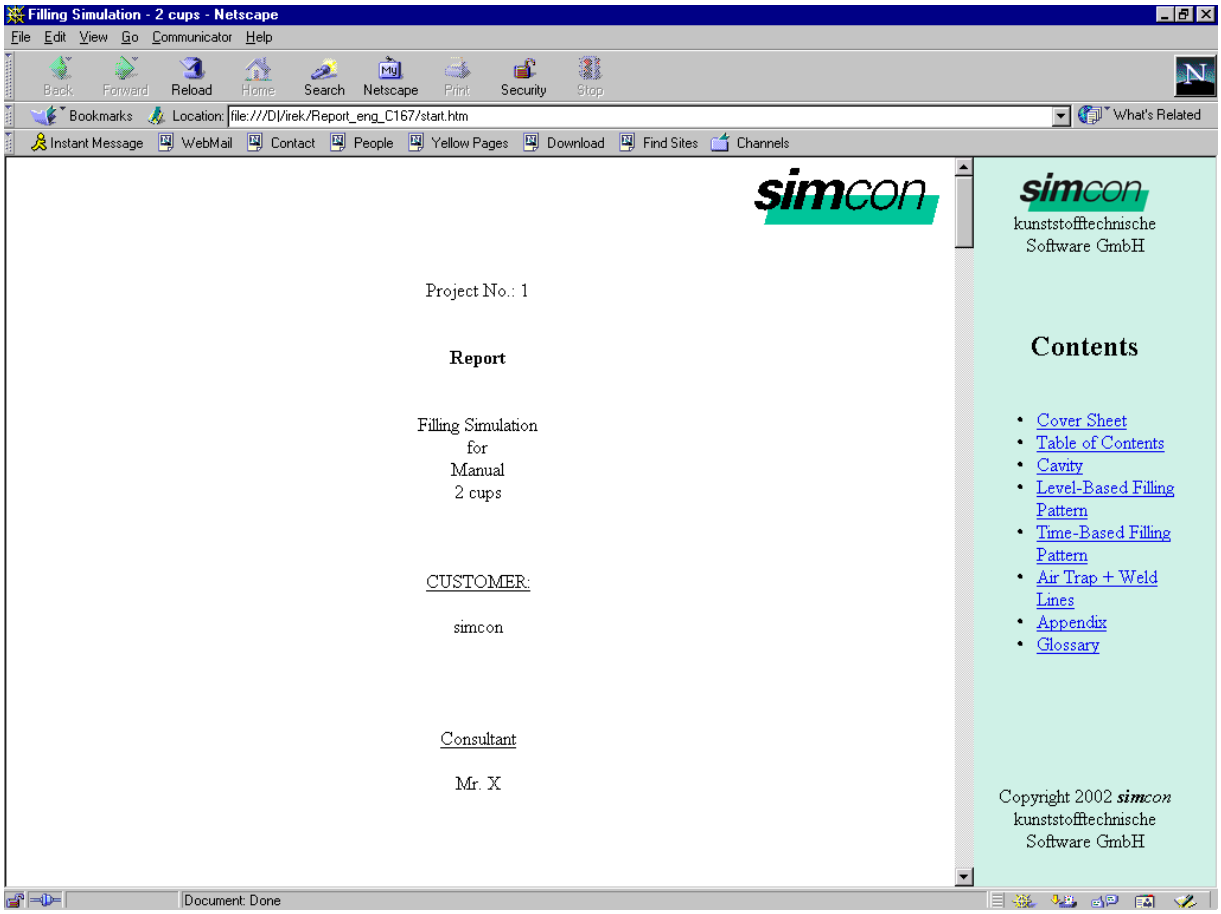
In this case the directory "John" is created.

(7) Click “OK”. Clicking “Apply” instead allows previewing the report and incorporating changes before finalizing the report with “OK”.

If there is already a report stored in the same folder, it would be overwritten, if you answer the next question with yes. If you don´t want to overwrite it, you have to select an new folder or rename the old one in the explorer.

The report is provided in an htm-file format and is opened in an Internet browser .The name of the report is the same as the name of the title of your report. The report is stored in the directory you have defined in the template “Options”.

(8) Click on "Yes" in order to open the report now.



9.1 Define a Report Standard

You can provide different report templates (RIL-files). Therefore it is possible of create different reports automatically, based on user-defined report templates.

(1) Activate the template "Figures" in the window "report" in order to create a report template.

(2) Click "Default".

⇒ The window "Open" appears on the screen.

In the directory where CADMOULD® 3D-F was installed to, are several RIL-files. Each RIL-ile stands for a language, e.g. ger.ril stands for German, eng.ril for English, ther-ger.ril for thermoplastic – German.

(3) Open the appropriate RIL-file in order to automatically generate result pictures of your part.

⇒ CADMOULD® 3D-F provides a standard report. You can edit and store the report. Use the functions "Edit", “Import” and "Remove" in the window "Report" in the template "Figures", in order to modify the report.

(4) After the editing of the report click on "OK ".

CADMOULD® 3D-F creates a RIL-file, which stores the appearance of your report. This file is stored in the same directory as your RM1-file of your part. So you can create further reports off this report.

You can provide several report templates, integrate texts and pictures into your reports. Use the functions "Import", "Edit" and "Remove" in the window "Report" in the template "Figures".

Notice: If you provide several report templates of the same part, then you have to rename the pertinent RIL-file after each newly created report.

9.2 Import Results

You can integrate your own result pictures or ***sim****con*-standard-report pictures into your reports.

(*See* chapter: "**Save Image**")

(1) Click "Import".

⇒ The window "Open" appears on the screen.

(2) Mark an image file and click "Open".

⇒ The following window appears on the screen.

(3) Enter a title and a comment in the fields "Title" and “Caption”. Then click “OK”.

9.3 Edit a Report

You can edit your reports with the function "Edit".

Mark a result and click on "Edit".

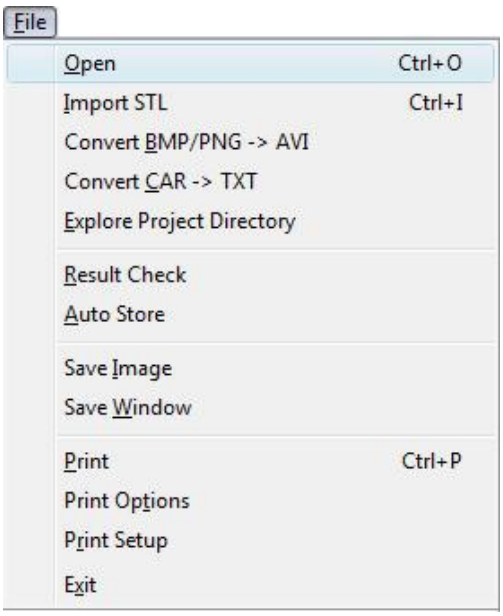
⇒ The selected result can be edited in the opening window.

10. CADMOULD® 3D-F VIEWER

CADMOULD® 3D-F VIEWER is a program of the ***sim****con* company, which serves for the representation of all CADMOULD® 3D-F simulation results. Additionally HTML project reports can be generated automatically. (*See* Chapter: **Report Filling Analysis**)

CADMOULD® 3D-F VIEWER needs a separate license. Please contact your distributor.

11. Menu Bar



11.1 File

Click "File".

⇒ The pull down menu "File" is activated.

In the pull down menu "File" you find instructions for handling the projects.

11.1.1 Open

The window "Open" appears on the screen. You can load an already existing result “RM1-file” or a design file “DES-file”.

RM1-files contain all information of a project.

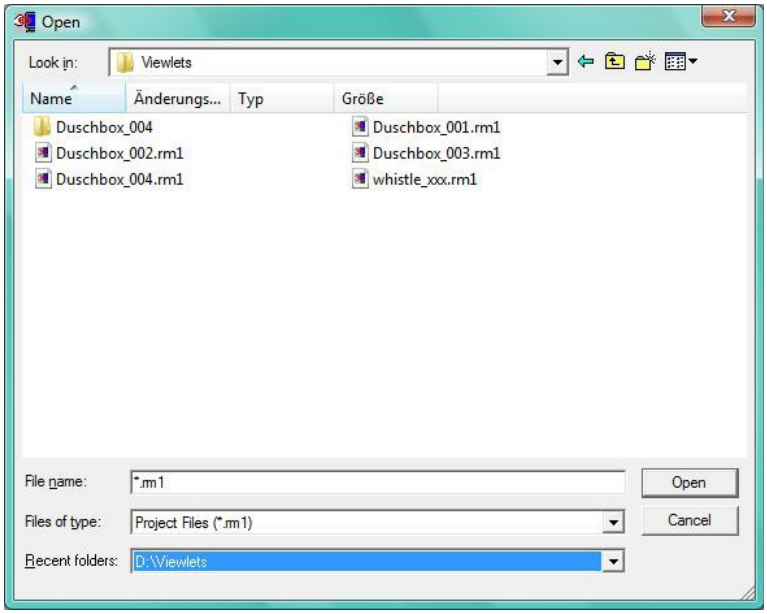
DES-files are project files. They are automatically created after you have determined a geometry title and a geometry identity number in the window "Simulations Description". The DES-file contains all necessary information to run a simulation, but the mesh has still to be prepared.

(1) Search the results of your part.

(2) Click on the file.

(3) Click on "Open".

(4) Wait until the geometry of the part is loaded and appears on the screen.



11.1.2 Import STL

(1) Click "**STL**", in order to load a new geometry.

⇒ The window "Open" appears on the screen.

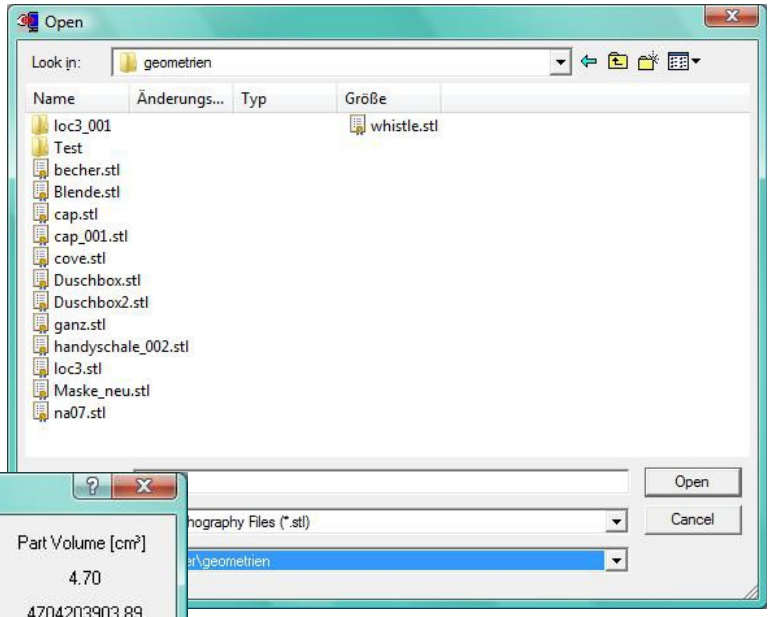
(2) Search the STL-File (stereo lithography file) of your part and select it.

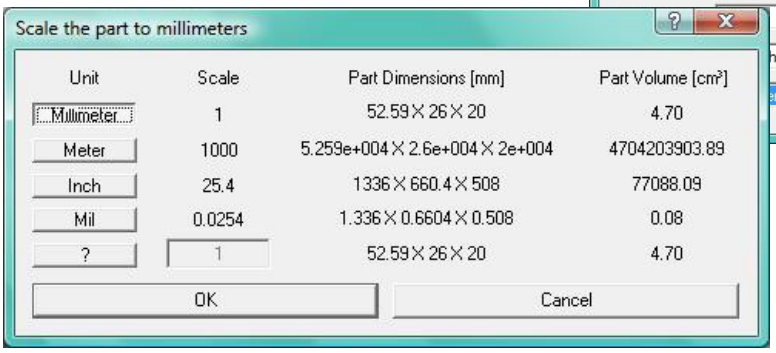
(3) Click "Open".

⇒ The window "Scale the part to millimetres" appears on the screen.

(4) Chose a scaling factor regarding the dimensions.

(5) Click "OK".




Scale the part to millimeters
Unit
Scale
Part Dimensions [mm]
Part Volume [cm³]
Millimeter 1 52.59 X 26 X 20 4.70
Meter 1000 5.259e+004 X 2.6e+004 X 2e+004 4704203903.89
Inch 25.4 1336 X 660.4 X 508 77088.09
Mil 0.0254 1.336 X 0.6604 X 0.508 0.08
? 1 52.59 X 26 X 20 4.70
OK
Cancel

(6) Wait until the geometry of the part is loaded and appears on the screen.

11.1.3 Convert BMP/PNG -> AVI

With this function you can generate an avi-file from a sequence of pictures.

Every picture takes the same time in the compiled avi.

See also chapter: Store Animations

11.1.4 Convert CAR -> Txt

CAR-files are result files. The result files can be converted into TXT-files by the function “Convert / CAR -> Txt”. This may be of interest if you want to interface results to other programs.

Convert the CAR-files by opening them. The TXT-files are automatically stored in the directory of the CAR-files, replacing the extension.

(1) Click on "CAR -> Txt".

⇒ The window "Open" appears on the screen.

(2) Select a file.

(3) Click on "Open".

The opened file was converted into a text file and stored in the same directory as your STL-file.

11.1.5 Explore Project Directory

Opens the Windows Explorer in the project folder.

11.1.6 Auto Store

CADMOULD® 3D-F provides, if the function is activated (standard), automatically a project backup file. In the field “Minutes” time interval between 1 and 60 can be given for the actualization of the project backup file.

In case of incorrect abort of a project, the project can be repaired and stored by clicking <Restore Session> and entering a title and identity number of the project in the new appeared window.

11.1.7 DeskArtes

The DeskArtes programs "3Data Expert" and "SimExpert" (starting with version 10.0) can repair parts selected in CADMOULD® 3D-F and then return the result via "File - Update in Cadmould" immediately back to CADMOULD® 3D-F, where the defective part is replaced automatically. If in CADMOULD® 3D-F more than a one part is present, a dialog "DeskArtes" appears, similar to the dialog "Delete" to

select a part for repair. If only a single part is present, the DeskArtes program will appear with the

part loaded immediately.

1. Import a STL file into CADMOULD® 3D-F.
2. Check, if the STL-Part is correct. Incorrect areas are represented in different colors as the rest of the part.
3. If your part is not correct, click **<Edit – DeskArtes>**.

→ The program DeskArtes starts with the incorrect part.

4. Repair the STL in DeskArtes.
5. In DeskArtes, click **<File – Update in Cadmould>**
6. The defectve part is replaced auomatically.

To use this function one of the programs “3Data Expert” or “SimExpert” from version 10.0 must be installed on your PC.

11.1.8 Save Animation

You can save an animation of time based results.

Please see chapter: 8.3 Store Animations

11.1.9 Save Image

The window "Save as" appears on the screen. You can store the current picture as a BMP-file (bitmap-file) or a PNG-file (Portable Networks Graphics-files).

Besides the possibility to save a well-known 2D-Picture, you can save a 3D-Picture. To this there are three 3-Dimensional image formats available.

You can find an introduction to the 3D-formats here:

Https://en.wikipedia.org/wiki/X3D

Http://en.wikipedia.org/wiki/Vrml

On the following web pages you can find programs to open these 3D-formats

http://www.web3d.org/x3d/wiki/index.php/Player_support_for_X3D_components

http://castle-engine.sourceforge.net/view3dscene.php

http://www.instantreality.org/downloads/

http://www.bitmanagement.com/de/download

Simcon dissociates itself hereby expressly from all designs and contents of all linked sites on this manual. simcon does not make these designs and contents its own.

11.1.10 Save Window

With this function you can take a screenshot of the opened windows. The window you select can be saved as PNG-file (Portable Network Graphic-File) or BMP-file (Bitmap-File).

Therefore point with the mouse pointer on the window you want to save.

⇒The window “Save As” appears on the screen.

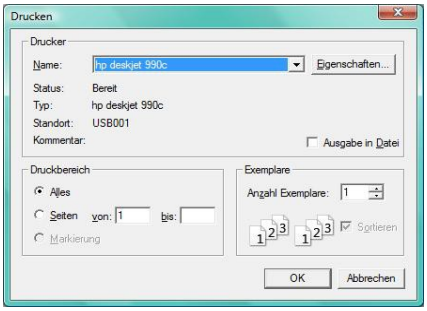
Chose a file name and file type before clicking “Save".

11.1.11 Print

In the menu "Print" you can define the printer characteristics and print your part.

For more information about the setting of the printing characteristics refer to your Windows and printer manuals or help function.

11.1.12 Print Option



The window "Print Option" appears on the screen.

In the field: "Image Size [%]" you can adjust the size of the print.

100% corresponds to DIN A4 sheet size.

50% correspond to DIN A5 sheet size.

In the field: "Resolution Reduction" you can set the factor, by which the print resolution is reduced.

11.1.13 Print Setup

The window "Print Setup" appears on the screen. This menu is used in the same way as Windows print setup.

For setting the printer characteristics you can refer to your Windows and printer manuals.

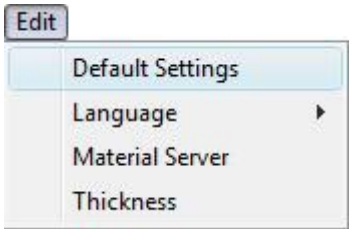
11.1.14 Recent File List

The 9 last opened files are in a list in the menu “File” for fast access.

11.1.15 Exit

Click “Exit” and “Yes” to finish CADMOULD® 3D-F.

11.2 Edit



Click "Edit".

⇒ The pull down menu "Edit" is activated.

In the pull down menu “Edit” you find the functions “Default Settings”, "Language" and "Thickness".

11.2.1 Language

The language of the dialogs can be changed if necessary.

Click on "Edit" and select the appropriate language.

11.2.2 Thickness

In order to be able to change the wall thickness, you need a display set to **more** than 65536 colors ((= High Color = 16 bit), i.e. True Color (= 24 bit or 32 bit)). This requires a graphic adapter/monitor combination that allows running this setting.

If your PC fits these requirements, you can change the wall thickness in the entire part, as well as in sub-areas of the part.

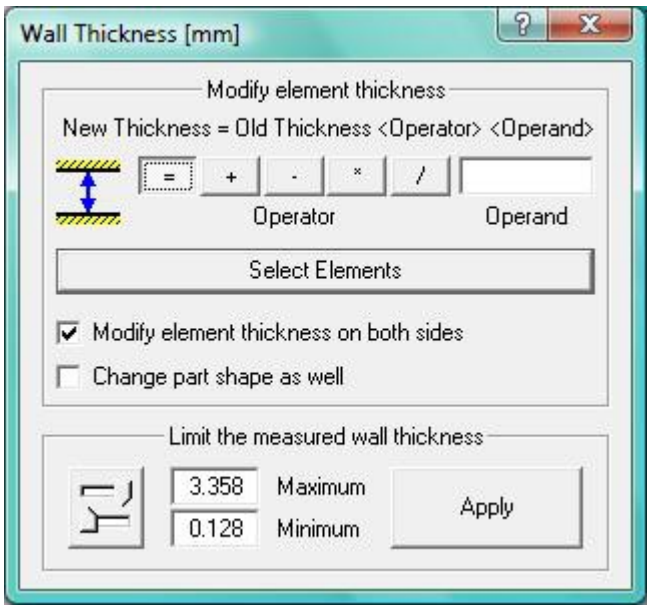
Changing the wall thickness

(1) Adjust the correct color depth, screen resolution and the sync frequency.
(see chapter: **“Thickness - Adjust the system settings”**)

(2) Load your part for which you must have a run a simulation or at least the mesh preparation phase.

(3) Click "Thickness".

⇒ The window "Wall Thickness [mm]" appears on the screen.



(4) Check local thickness values by pressing the <Ctrl> key and clicking onto the part. The thickness will be displayed on the status line at the bottom.

Follow the instructions in the window:

(5) Chose an operator (=, +, -, x, /). This will by applied to the area selected in the next steps.

(6) Give a value (operand) fitting your plan.

(7) Click “Select Elements”. (*The window: “Result Selection” should be closed.*)

⇒ The window: “Wall Thickness [mm]“ disappears.

(8) Select Elements using the Selection Tools listed in the following table.

Table: **Selection Tools**

Tool	Description
RECTANGLE	All elements completely enclosed by the rectangle
CIRCLE	All elements completely enclosed by the circle
POLYGON	All elements completely enclosed by the polygon
PLANE SURFACE	All elements on a surface
INFINITE PLANE	All elements on a plane
BOUNDED SURFACE	Surface definition based on the selected element situation to his neighbor elements. (*An angle have to be defined*)
ALL	All elements
SINGLE	Single element (*Selection end => right mouse button*)
DISTANCE	All elements completely enclosed by the chosen distance

Switching between the individual tools:

F4 or Shift + F4 by an active CADMOULD® 3D-F operating surface.

Example: Selection tool **RECTANGLE**

(9) Drag opens a rectangle around the area to be modified.

⇒ By an active option "☑ ***Change part shape as well***" the CFE – mesh is actually changed on one or both sides *(option: "☑ **Modify element thickness on both sides**")* by the given arithmetic operation.

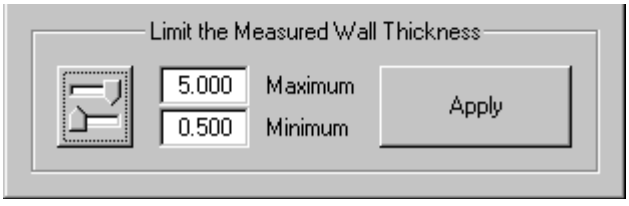
The CFE - mesh and concomitantly the volume of the shaped part change.

(10)Repeat the operation to change all elements to be modified.

(11)Run a new simulation.

Limit the measured wall thickness

The measured wall thickness can be limited by the function "Displayed Limits" and with the key "Apply" the limited wall thickness interval can be forced for the next simulation.



All too thin triangle elements and wall to wall bounds are set on the interval lower limit. The too thick triangle elements are set on the upper limit, while the too thick wall to wall bounds are removed.

Thickness - Adjust the system settings

Be sure to have the rights to modify the settings.

(1) Click “Start“ and go to “Settings“

(2) Click “Control Panel“.

⇒ The window “Control Panel” appears on the screen.

(3) Activate "Display" with double-click.

(4) Click "Settings".

(5) Adjust the system settings to “True Color”. Mind that changing the color depth may affect the display resolution and the sync frequency, changing them to unacceptable low values.

11.2.3 Default Settings

This function restores the CADMOULD® 3D-F default settings.

11.3 View

Click "View ".

⇒ The pull down menu "View" is activated.

In the pull down menu "View" you find instructions for customizing the user interface and changing the look of the mould part.

11.3.1 Toolbar

The checkmark (√) shows the visibility of the “Toolbar“.

- Click “Toolbar“, in order to show or hide it.

11.3.2 Status Bar

The checkmark (√)shows the visibility of the “Status Bar“.

- Click “Status Bar“, in order to show or hide it.

11.3.3 Colors

Define the color of the objects “Air-Trap”, “Background”, “Cutting Plane”, “Element Edges”, “Flow Direction”, “Flow Path”, “Gate”, “Part”, “Results”, “Selected Objects” ans “Weld Lines” in the same manner as described below in the example “Air Trap”.

11.3.3.1 Air Trap

(1) Go to "Colors" → Air-Trap

(2) Wait for the menu “Air-Trap Color” to appear on the screen.

(3) Click “Air Trap“.

(4) The window "Air Trap Color" appears on the screen.

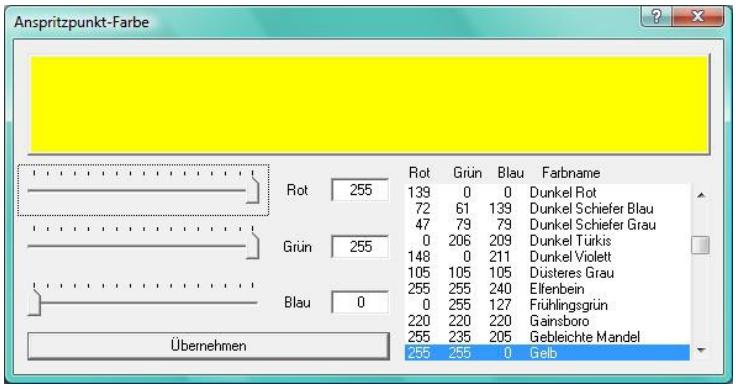
(5) Adjust the three sliders,

or

enter RGB components in the range 0 – 255 in the respective input fields,

or

click a color in the table.



(6) Click “OK” to activate the selected color.

11.3.3.2 Results

11.3.3.2.1 Default (color scale: 0 - 255)

(1) Go to “Colors” ⇒ “Results“.

⇒ a further menu appears on the screen.

(2) Click "Default".

11.3.3.2.2 *simcon* (color scale: 0 - 14)

(1) Go to “Colors“ ⇒ “Results“.

⇒ A further menu appears on the screen.

(2) Click "***sim****con*".

11.3.3.2.3 Gray (black-and-white)

(1) Go to “Colors” ⇒ “Results”.

⇒ A further menu appears on the screen.

(2) Click "Gray".

11.3.3.2.4 Traffic Light

(Applicable for some quality results.)

(1) Go to “Colors” ⇒ “Results”.

⇒ A further menu appears on the screen.

(2) Click "Traffic Light".

11.3.3.3 Background

The option "Image ➔ White ☐" sets the background to white on images, independently from the screen background color. The current setting of the option is stored permanently in the registry. The default is not to use a separate white image background. The intention behind the option is to save ink when printing images, as the color white is left blank on printouts

11.3.3.4 Part

A color can be assigned to the part. Preset is grey.

1) Click on “Color” → “Part“.

⇒ The window "Part Color" appears on the screen.

2) Adjust the three sliders,

or

enter RGB components in the range 0 – 255 in the respective input fields,

or

click a color in the table.

3) Determine the shaped part, to which it is to be assigned.
4) Click <**Apply**> to activate the selected color.

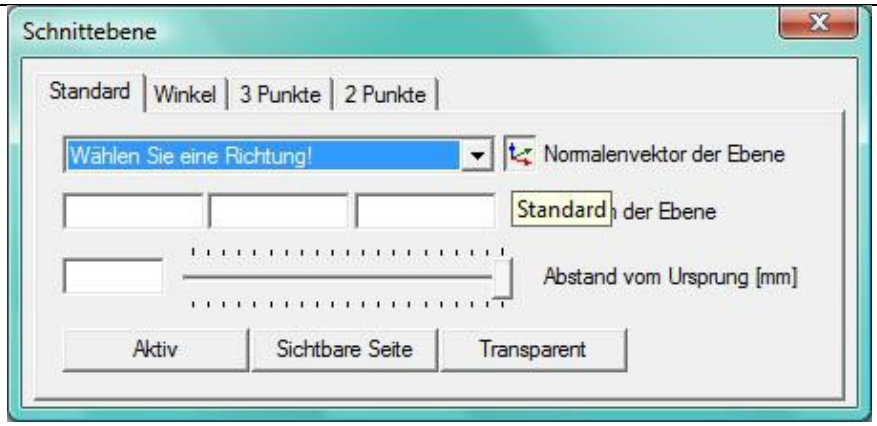
11.3.4 Cutaway

Often parts have areas not easily visible from outside. To access these areas, you can cut your parts with the function “Cutaway”.

(1) Click "Cutaway".

⇒ The window "Cutting Plane" appears on the screen.

Register - Standard



(2) Choose the normal vector of the cutting plane in the pull down menu or click on the coordinate axis, to enter the vector manually.

(3) Click the button "active" to activate the display of the cut.

(4) Move the slider to control the position of the cutting plane

or

define a point in the cutting plane by entering the coordinates or digitalizing a point on the surface of the part.

(5) Click "Visible Side" to change the visible side at the cutting plane.

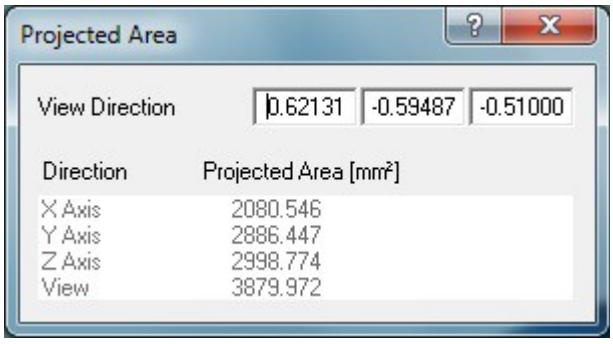
(6) Activate "Surface" to show the cutting plane as non translucent surface.

On the following registers, you can define the cutting plane by other possibilities:

- Choose "**Angle**" to rotate the X-Y plane and move this plane into a certain point.
- Choose "**3 Points**" to define a plane by giving the coordinates of three points lying in the cutting plane
- Choose "**2 Points**" to define a cutting plane by giving the coordinates of the beginning and the end of the normal vector.

11.3.5 Projected Area

These function shows you the normal vector of the screen plane and the projected area of your part in X-, Y- and Z- as well as in viewing direction.



11.3.6 Font

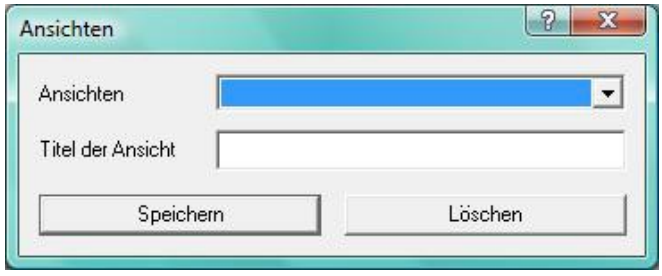
You can choose the font for the scale, the title and the name of geometry.

11.3.7 Save

You can store different views of your part. These are valid in the current directory.

Click "Save".

⇒ The window „Views" appears on the screen. Loading may take some time in a directory with many files.



11.3.7.1 Store Views

(1) Identify the view, which you would like to store, by entering the name into the field: "View Title".

(2) Click "Save".

⇒ The name of the selected view appears in the field "Stored Views", after the view is stored.

11.3.7.2 Select A View

(1) Click the arrow in the field "Stored Views", in order to select a stored view.

(2) Click on the selected view.

11.3.7.3 Delete A View

Mark a stored view and click "Delete".

11.3.8 Split Screen

You can compare results of different simulations of a part in split windows.

For this choose a screen splitting mode and open a simulation in every window. If you now open a result in the main window (not “Remote Controlled” in the status bar), this result will be displayed in all windows. Also, if you move your part in the main window, it will move the same way in all “Remote Controlled” windows.

11.3.9 Standard Views

With each of these functions you can choose from two standard views.

11.3.10 Zoom

Zoom allows to magnify specific areas of the display.

11.3.10.1 Full size

Click "Zoom -> Full Size" to project the full part on the screen.

11.3.10.2 Rectangle

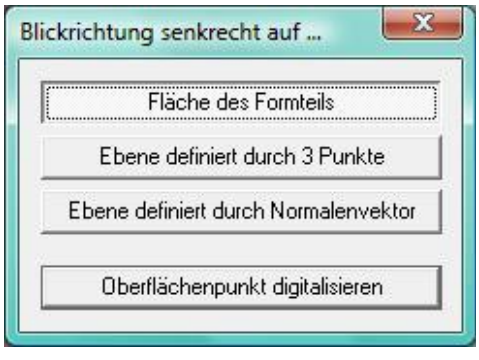
(1) Click "Zoom -> Rectangle".

(2) Drag open a rectangle on screen.

(3) Release the mouse button.

11.3.11 Look vertically at...

The exact definition of the aspect of your part is very important for the calculation of the clamping force.



1) Click < Look vertically at... >.

⇒ The window “Look vertically at...” appears.

You can define the line of sight in four different ways.

Look vertically at...:

- Surface of the part

  1) Push the button and select with “Ctrl + left mouse button” a surface of the part.

- Plane defined by 3 points

  1) Push the button down and push afterward the button “Digitize 3 points”.

  2) You can now select three points on the surface of the part, which will define the plane.

  Please consider also the note to the “Point on... function”.

- Plane defined by normal vector

  1) Push the button down and push afterward the button “Enter the normal vector”.

  2) You can enter the normal vector in the window, that appears on the screen.

11.3.12 Projection

With this functions you can switch between orthogonal and perspective view.

Switching between orthogonal/perspective and stereoscopic view while the program is running is not possible at the moment. Therefore you have to restart the program.

Please see also chapter: 3.2 3D-Display with stereo projection

11.3.13 Options

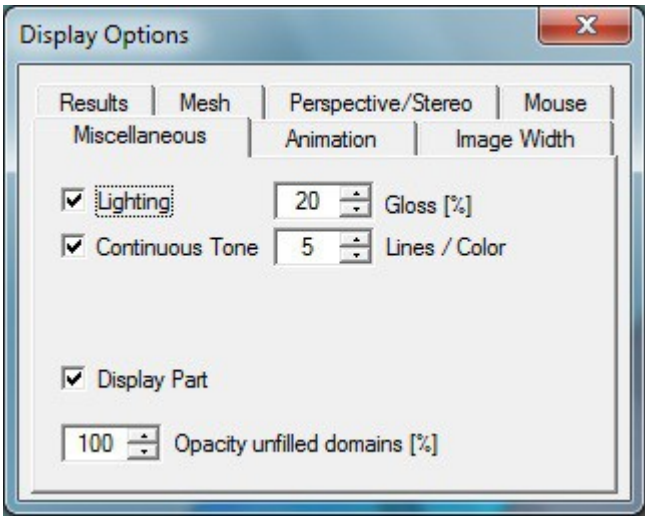
The display of your part on the screen can be altered.

11.3.13.1 All

Click "Options->All".

⇒ The window "Display Options" with all tabs appears on the screen.

On the following commands you can call up every tab directly.



11.3.13.2 Miscellaneous

11.3.13.2.1 Lighting

The checkmark (√) activates the „Lighting“.

- Click „Lighting“, in order to activate or deactivate it.

11.3.13.2.2 Gloss [%]

You can affect the representation of the results on surfaces parallel to the screen by the function “Gloss [%]”. Lower values mean less mirroring.

11.3.13.2.3 Continuous Tone (continuous color)

The checkmark (√) activates "Continuous Tone".

- Click "Continuous Tone" in order to activate or deactivate it.

11.3.13.2.4 Lines / Color

You can define the way your results will be represented in "Lines / Color". This becomes active only if you have deactivated "Continuous Tone" before.

- Mark the displayed number and enter the desired number of lines per color by keyboard,
  or
- click the arrows up or down, until the desired number of lines per color is displayed.

11.3.13.2.5 Display Part (geometry on / off)

The checkmark (√) activates "Display Part".

- Click "Display Part" in order to activate or deactivate it.

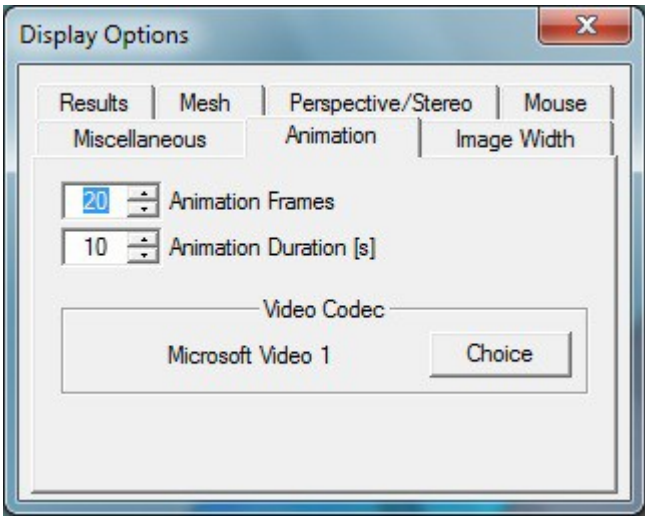
11.3.13.2.6 Transparency unfilled domains [%]

This function gives you the possibility to view the flow front in the inside of the part. For this choose a value smaller than 100%.

Please see also chapter: 5.4 3D-Flowfront

11.3.13.3 Animation

11.3.13.3.1 Animation Frames



Here you can pre-define the number of animation pictures.

- Mark the number and enter the number of pictures

or

- click the arrows up and/or down, until the appropriate numerical value is indicated.

11.3.13.3.2 Animation Duration

Here you can pre-define the duration of the animation.

- Mark the number and enter the time [s]

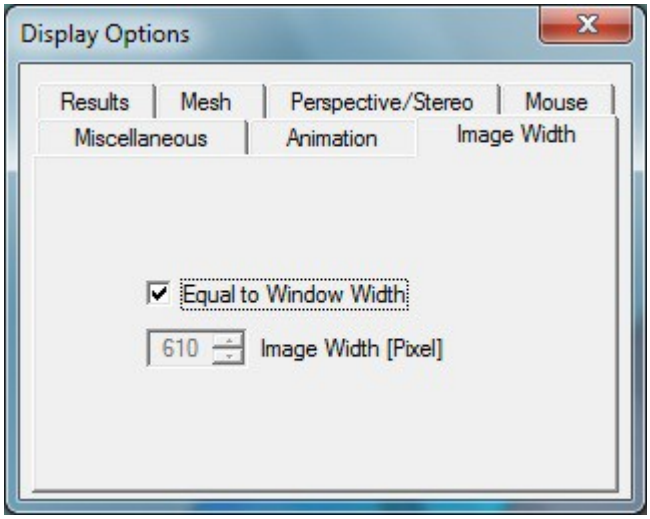
or

- click the arrows up and/or down, until the appropriate numerical value is indicated.

11.3.13.3.3 Video Codec

You can choose from different codecs, to store your animation.

11.3.13.4 Image width in image files



Define the width of the pictures that are stored on your command or automatically while generating a report.

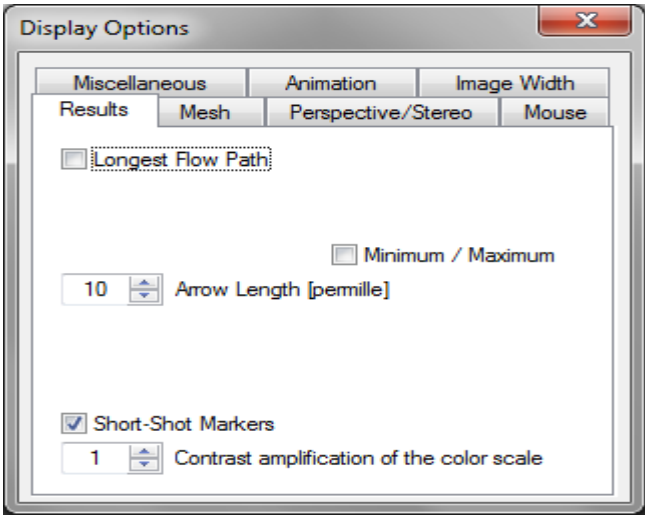
The checkmark (√) activates the „Equal to window width“.

- Click „Equal to window width“, in order to activate or deactivate it.

or

- predefine the image width by entering the pixel number. The pictures will be recalculated in the background in the given size.

11.3.13.5 Results



11.3.13.5.1 Longest Flow Path

The checkmark (√) activates "Longest Flow Path".

- Click "Longest Flow Path" in order to activate or deactivate the display.

11.3.13.5.2 Minimum / Maximum

Activate this function to see a blue resp. red pin showing the minimum resp. the maximum value of the result.

The function is available for example for the most results, wall thickness and others.

11.3.13.5.3 Arrow Length (permille)

Here you can define the length of the velocity-arrows.

- Mark the number and enter length of the velocity-arrows

  or
- click the arrows up and/or down, until the appropriate numerical value is indicated.

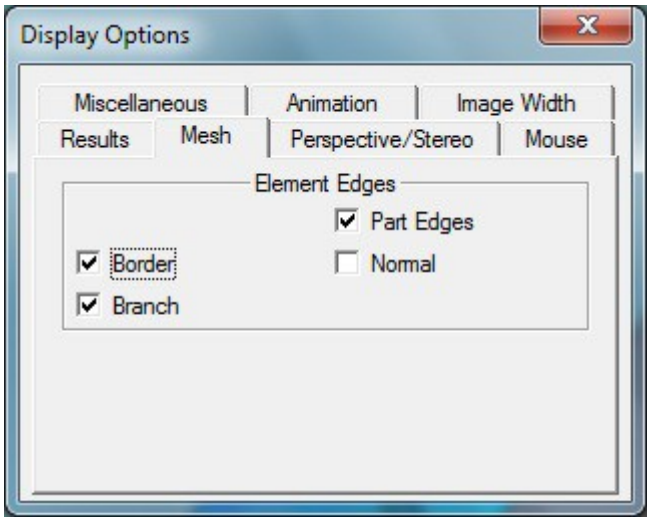
11.3.13.5.4 Short-Shot Markers

If the flow front is frozen during the filling simulation, the unfilled nodes are marked with blue balls. The unfilled nodes are displayed constantly when the checkmark is set here.

11.3.13.5.5 Contrast Amplification of the color scale

This integer (with the exception of zero) changes the normally linear relation between result value and color.

11.3.13.6 Mesh

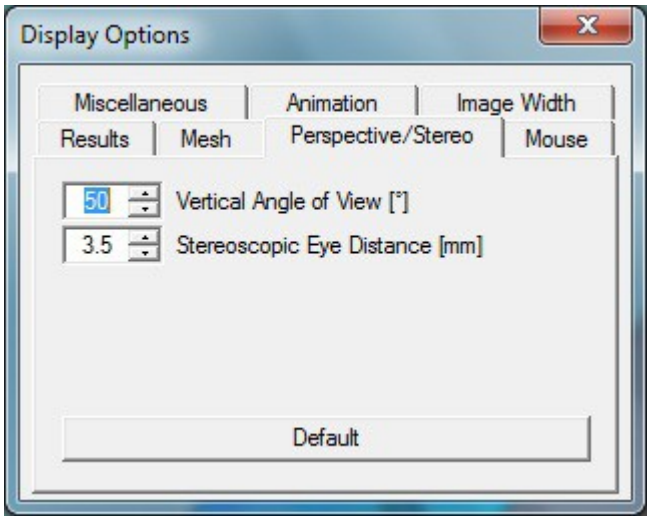


11.3.13.6.1 Element Edges

The checkmark (√) activates the display of the different “Element Edges“.

- Click "Part Edges" in order to activate or deactivate the part edges.
- Click "Normal" in order to activate or deactivate the display of the FE-mesh.
- Click "Border" to see element egdes on the border of the mesh. (Errors in the mesh)
- Click "Branch" to see element edges which connect more than 2 elements. (Errors in the mesh)

11.3.13.7 Perspective/Stereo



On this tab you can define settings for the perspective/stereoscopic view.

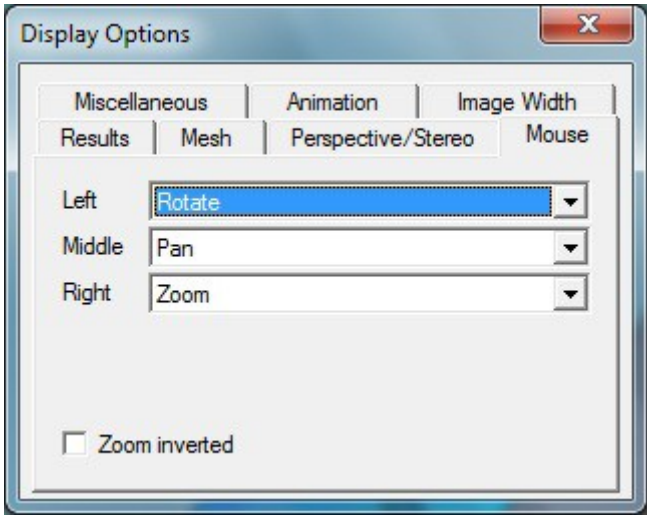
Vertical Angle of View [°]

This value defines the viewing angle for the perspective view.

Stereoscopic Eye Distance [mm]

This value defines the eye distance for the stereoscopic view.

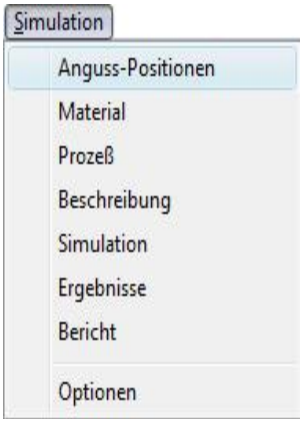
11.3.13.8 Mouse



On this tab you can define the function for each mouse button.

The function “Zoom inverted” inverts the direction of the mouse movement for zoom, as well as for the scroll wheel.

11.4 Simulation



Click "Simulation".

⇒ The pull down menu "Simulation" is activated.

In the pull down menu "Simulation" you find the following commands: Gates, Material, Process, Description, Simulation, Results, Report and Options.

You can select these with a mouse-click or by keyboard.

(*See* chapter: **"Mouse Control + Keyboard"**)

11.4.1 Gates

(1) Click "Gates".

⇒ The window "Gate Locations" appears on the screen.

(2) Now, you can enter, edit, delete and optimize gate locations.

(For details please see Chapter: "**Define a gate location**")

(3) Click "OK" in order to accept the entered gates.

(4) Click "Cancel", in order to abort the input.

11.4.2 Material

In order to define the material of the part, a delivery material database is at your service. You can limit the search range, by entering the material name, the supplier or the material class.

You can create user-database with your own material. Therefore you can copy material data with the CADMOULD® 3D-F i0-format or in the Cadflow neutral-file format from the delivery database or from user-database into your own user-database. The user-database can be extended with own material data.

11.4.2.1 Enter the material

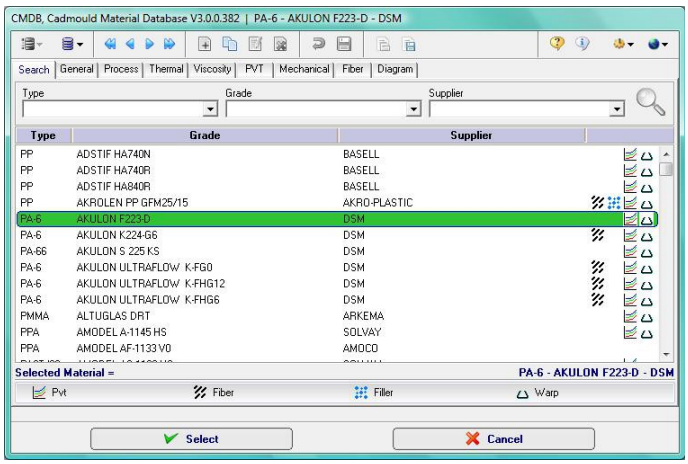
(1) Click "Material".

(2) Wait, until the window "CADMOULD® 3D-F material database" appears on the screen.

(3) Search for the material you want to use.

(4) Click on the material.

(5) Click "Select" to finish the selection.



Limit the search range

Seek after:

a) material class

(1) Click the arrow "Type".

- A list of the existing materials appears.

(2) Click on the material class of the material you are looking for.

⇒ All the materials of this material class are indicated.

b) material name

Type the initial letters or a part of the name of the material into the field “Material Name”.

- A list of the existing materials fitting this criterion is displayed.

c) the supplier

(1) Click the arrow "Supplier".

- A list of the existing suppliers appears.

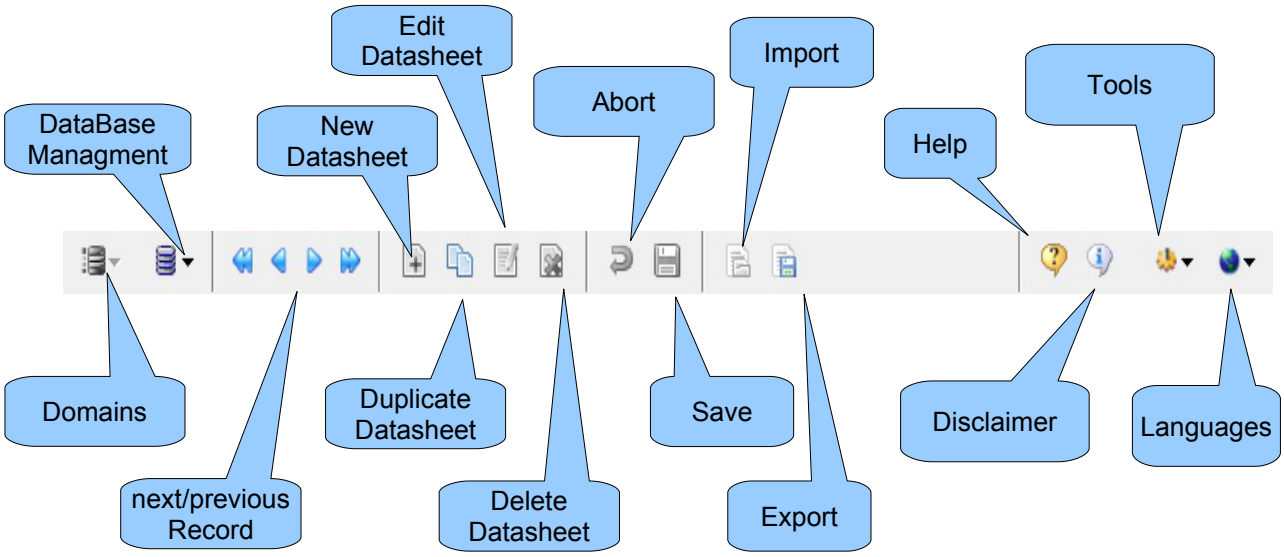
(2) Click on the supplier of the material you are looking for.

⇒ All materials of this supplier are indicated.

Caption:

The caption shows you the meaning of the symbols, which you can find in the last column of the table. These column shows, which data are available for this material.

11.4.2.2 Toolbox: CADMOULD® 3D-F material database



11.4.2.3 Add your own material data into material database.

If you want to add own material data, you have to create an user-database, because the materials in the delivery database can´t be edited. They can only be copied into the user-database and be edited there. Use therefore the function “Duplicate Datasheet”. We´ll show you now how to create a new material data sheet.

(1) Click "Material".

(2) Wait, until the window "CADMOULD® 3D-F Material database" appears on the screen.

(3) Switch to the user-database, by button “Database management” or create a new one.

(4) Click "add new record".

⇒ The window "Material data" appears on the screen.

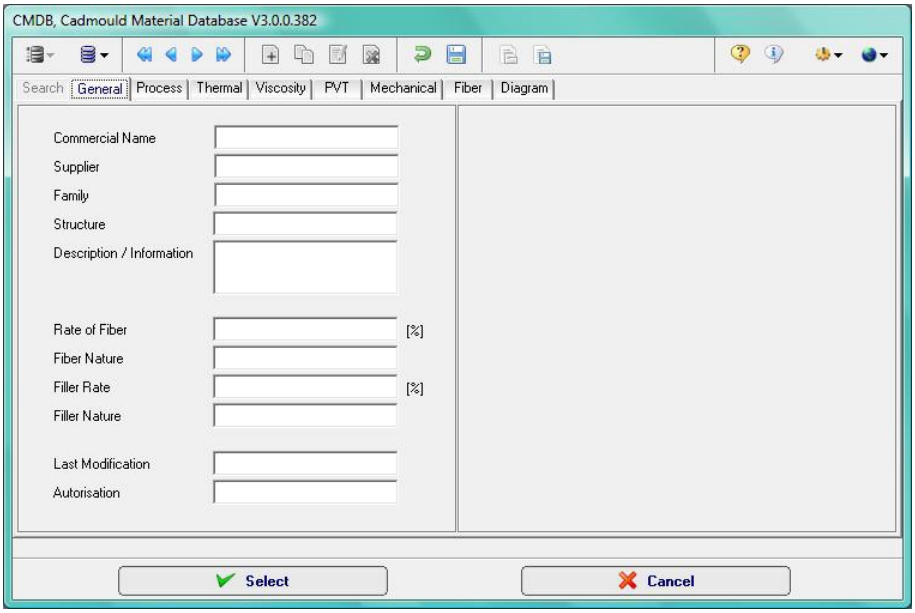
(5) Enter the material name, type, and supplier. Without these data the data record cannot be stored.

(6) Click on "Viscosity".

(7) Enter the Carreau- or the Cross-Coefficients.

(8) Click "Thermal".

(9) Enter the thermal data.



Note: CADMOULD® 3D-F, CMSolver and CADMOULD® 3D-F RAPID can simulate with temperature dependent thermal material properties. The material database is extended as well. The data will be saved in tables in the database. If the chosen material has a temperature dependency, the program will use this data set, but only if pvT-data are present as well. The temperature dependent thermal material properties will be written in the dialog "Simulation Description".

(10) Click "PVT".

(11) Enter the pvT parameters, either by IKV-, Renner- or 2-domain-tait-ansatz

(12) Click "Mechanical".

(13) Enter the mechanical data.

(14) Save the data record by clicking “save changes”

or

chancel your data by clicking “cancel changes”

During the input an examination of the input values takes place.

Necessary inputs are:

- Name
- Type
- Supplier
- Rheological data
- Thermal data (conductivity, diffusivity and no-flow temperature)

11.4.2.4 Diagrams in the CADMOULD® 3D-F material database

For the following material properties the appropriate diagrams can be represented in the database:

- ♦ viscosity
- ♦ pvT parameters
- ♦ mechanical data (Young's modulus and Poisson's ratio)

Click on diagram and choose one, by selecting it from the list with the green arrow.

Note: Diagrams are only shown, if the optimal processing temperatures are entered on the register process.

11.4.2.5 Data exchange

The CMDB serves two possibilities to exchange data between different database or to dispatch material data.

11.4.2.5.1 Export

(1) Click "Material".
(2) The window "CADMOULD® 3D-F Material database" appears on the screen.
(3) Select a material.
(4) Click on "Export"
(5) Give a file name and choose the file type: "Cadmould i0" or "Neutral File".
(6) Save the material data.

The material data are saved as TXT-file (Cadmould i0) or as PLB-file (Neutral file, recommended, because in this file format all material data is saved) and can be imported into a user database or be forwarded.

Note: Material data is a component of the CADMOULD® 3D-F software. Consider please the copyright regulations. Therefore the export function is only available, if the database is started out of the program window of CADMOULD® 3D-F.

11.4.2.5.2 Import

I0-files are TXT-files. Neutral-files are PLB-files. Both file types and can be imported into a CADMOULD® 3D-F user database.

(1) Click "Material".

(2) The window "CADMOULD® 3D-F Material database" appears on the screen.

(3) Click on "add new record" or "edit this record".

(4) Click "Import".

(5) Open the appropriate file.

(6) The material date is read in into the input fields.

(7) Save the material data.

11.4.3 Process

With "Process" you define the process parameters.

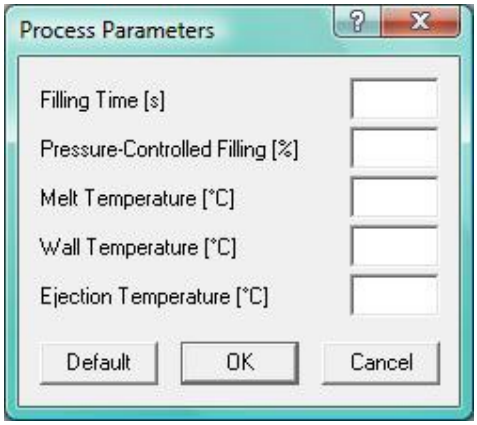
(1) Click "Process".

⇒ The window "Process Parameters" appears on the screen.

(2) Define the Filling Time, Pressure Controlled Filling, Melt Temperature, Wall Temperature and Ejection Temperature,

or

click "Default", if you want to use proposed values.



The system suggests the average value of the indicated temperature ranges of the material. The Pressure Controlled Filling is pre-set to start at 99% filling level.

(3) Change the values, if you do not accept them.

(4) Click "OK", if you accept the parameters.

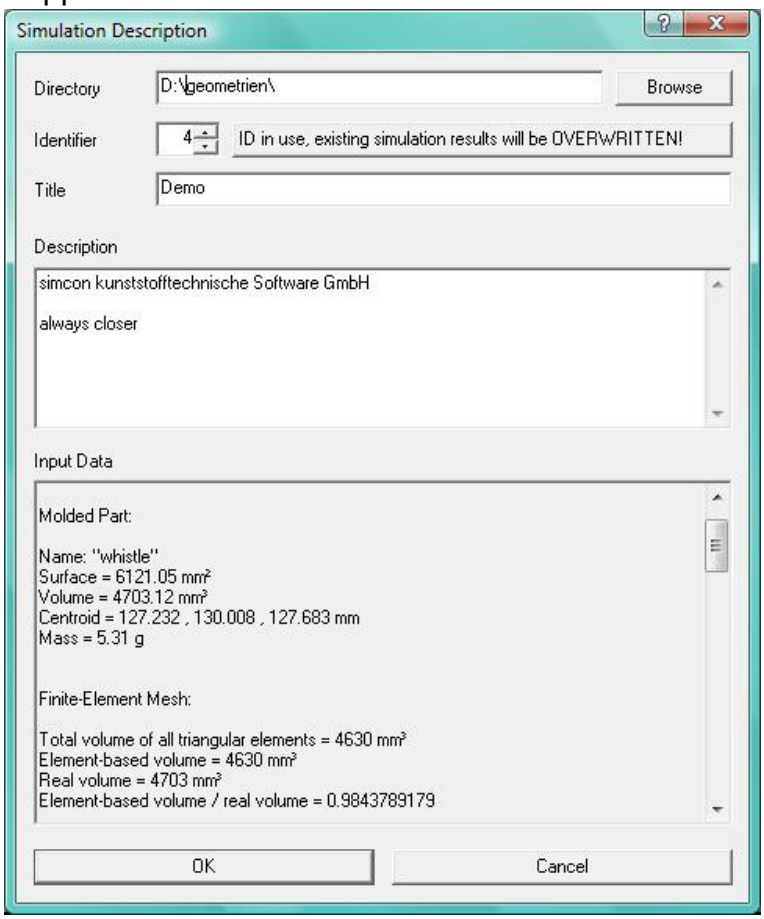
(*See* chapter: **Define the process conditions**)

11.4.4 Description

In "Result Identifier" you must enter the identification number, under which the simulation data are stored or use the system default. You must describe the simulation with some key words in “Title”. You can give further explanations about your simulation in “Description”.

(1) Click "Description".

⇒ The window "Simulation Description" appears on the screen.



(2) Examine the path in which the results are stored.

a) They are OK

⇒ Continue with point (3).

b) They are not OK

1) Click "Browse".

⇒ The window "Browse for Folder" appears on the screen.

2) Define the proper directory.

3) Click "OK".

(3) Enter the identification number in "Result Identifier".

The button to the right of the input field indicates the state of the selected number. Clicking on it selects the lowest unused number.

(4) Enter a short name for the simulation run in "Title".

(5) (optional) Describe the simulation process in the field "Description".

(6) Click "OK".

11.4.5 Simulation

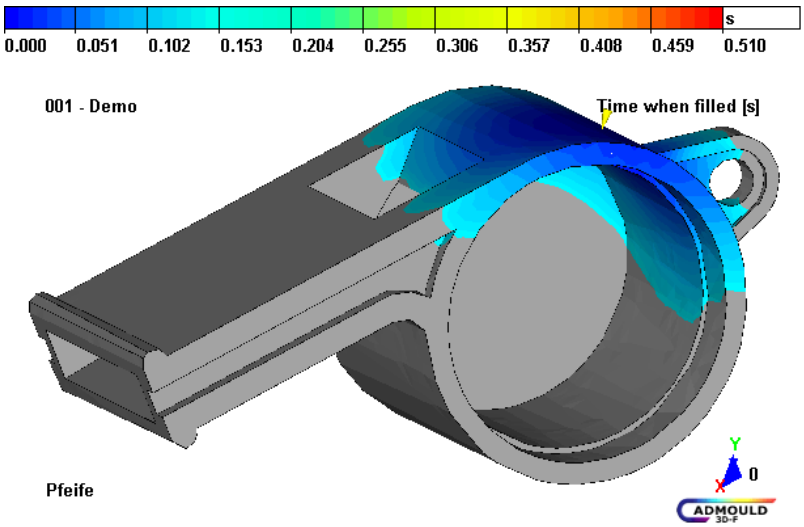
You start the simulation run of the injection molding by clicking "Simulation".

Before you start the simulation, please consider the chapter:

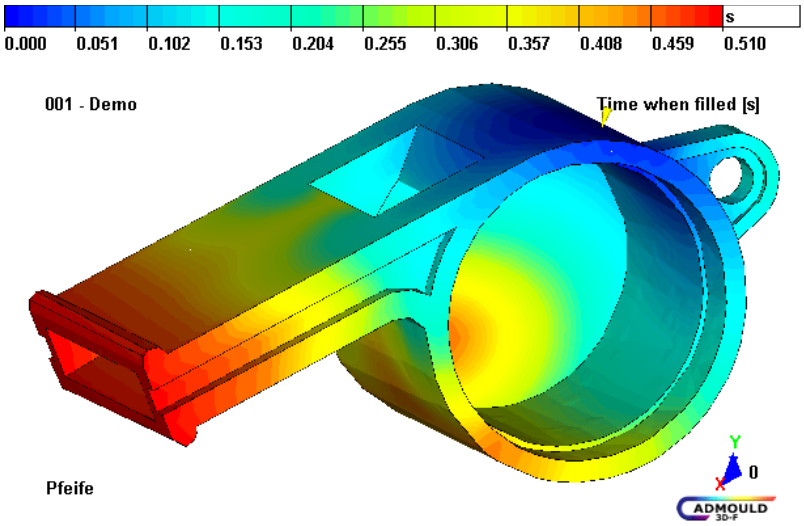
"Options"

(1) Click "Simulation".

(2) Wait until you get a message that the simulation is completed.



While the simulation is running intermediate results will appear on the screen.



The simulation is finished.

11.4.6 Results

This function opens the window "Result Selection".

(See chapter: "Result Selection")

11.4.7 Report

This function opens the window "Report".

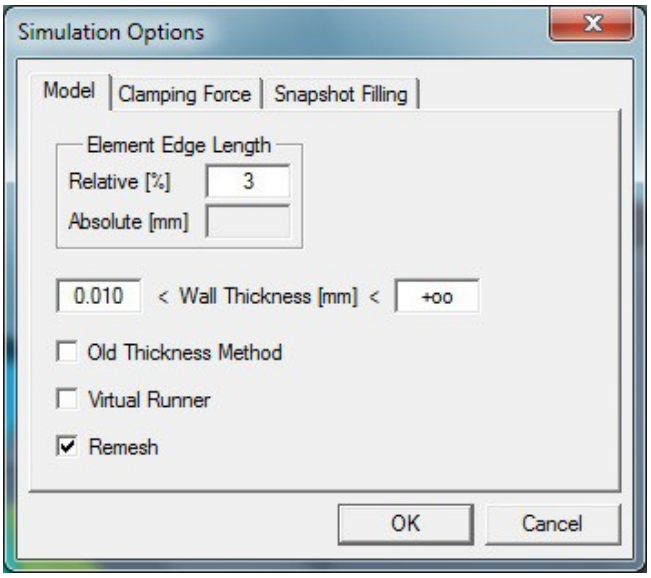
(See chapter: "Report Filling Analysis")

11.4.8 Options

(1) Click “Options”

⇒ The window: “Simulation Options” appears on the screen.

11.4.8.1 Model



11.4.8.1.1 Element Edge Length

Enter a „Relative Length [%]“ (between 0.1 and 10) or an “Absolute Length [mm]” to define the accuracy of the results. The smaller the value, the more exact the results, however, the number of elements and the computing time increases.
The relative length is defined by the body diagonal of the bounding box of your part.

11.4.8.1.2 Wall Thickness

Enter a minimum and maximum wall thickness of the part. The limitation of the wall thickness is to prevent that wall thickness is not generated long the part.

11.4.8.1.3 Old Thickness Method

The algorithm for wall thickness determination was changed some versions back. Calculating on the old wall thickness method may be recommended infew cases.

11.4.8.1.4 Virtual Runners

This option changes the distribution of the defined flow rate to the different defined runner positions.
If this option is not activated, the flow rate will be evenly distributed to the runner positions. Thus it can come to different pressures at the runner positions during the fill process, e.g if the mould has different wall thickness.
Especially in the last phase of the mould filling it can give a high pressure rise, caused by imbalance, if the material is pressed into an already filled section. In reality, the material will evade over another section.
By activating this function you can make allowance for this behaviour. From now on one pressure level will be held at all runner positions. That will cause, that each runner position has another flow rate, which complies in summation to the defined value.
To attain a realistic result, the function "Virtual Runners" is activated by default.

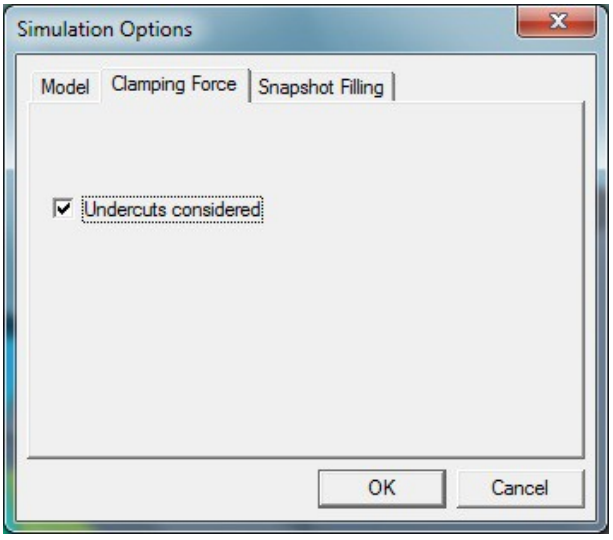
11.4.8.1.5 Remesh

During remesh, connected areas of elements lying in the same plane are identified. The boarding element edges of such an area remain, whereas the inside will be remeshed with elements of better quality.

Note: The option remesh can cause longer calculation times.

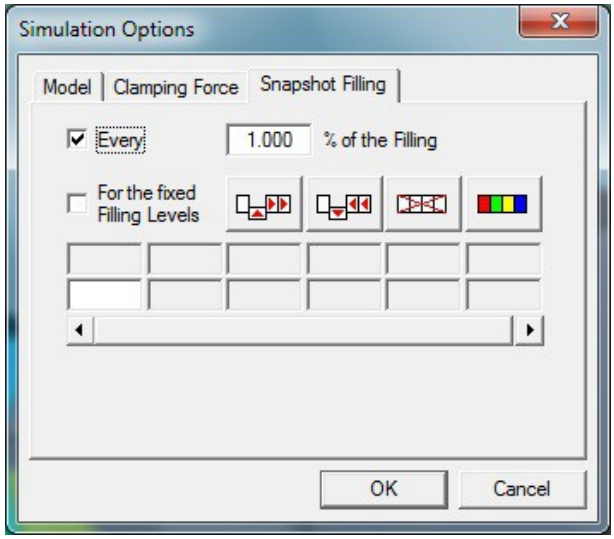
11.4.8.2 Clamping Force

Using symmetries, you can take into account undercuts for the calculation of the clamping force. This can extend the simulation time significantly. In this case it is advised to calculate without undercuts and take into account the real situation by multiplication.



11.4.8.3 Snapshot Filling

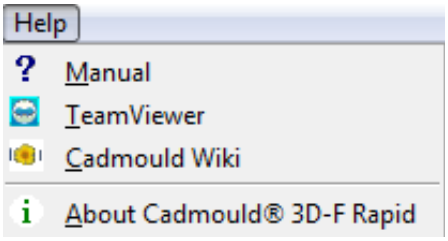
A result storage interval and fixed filling levels can be defined.



- Result storage interval
  Every ...% of filling
- fixed filling levels
  Entering of fixed values

The Buttons from left to right:
insert column, delete column, all columns delete, insert default values.

11.5 Help



Click “Help”.

⇒ The pull down menu ”Help“ is activated.

In the pull down menu “Help” you find the following instructions: “About CADMOULD® 3D-F RAPID” and “Manual“. You can select them by mouse-click or by keyboard.

(*See* chapter: **“Mouse Control + Keyboard”**)

11.5.1 Manual

(1) Click “Manual” to look up the help.

⇒ The manual appears on the screen as a PDF-file.

(2) Search your help topic from the table of contents (manual: *page:* 2) or from the reference register.

11.5.2 Cadmould Wiki

Click on “Cadmould Wiki” to enter the site http://cadflow.fr/wiki

11.5.3 TeamViewer

TeamViewer is getting installed automatically with CADMOULD® 3D-F on your PC. With this software you can show your screen contents the CADMOULD® 3D-F support team. For it, you get an ID and a password from TeamViewer which you submit to the support team by phone.

11.5.4 About CADMOULD® 3D-F RAPID

Click “About CADMOULD® 3D-F” to get some information about CADMOULD® 3D-F, e.g. the version number, addresses, E-Mail-Contact and Homepage

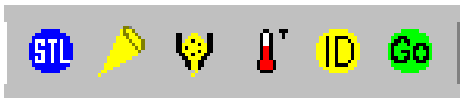
12. Controls

12.1 Toolbar

The buttons represent the most important commands of CADMOULD® 3D-F. They are organized in groups. Click the individual buttons, in order to select the command you want to use.

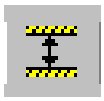
These buttons contains the commands: "Open", "Print", „About CADMOULD® 3D-F“, „Manual“. These corresponds to the same instructions: "Open", "Print" in the pull down menu: "File" and „About CADMOULD® 3D-F“, „Manual“ in the pull down menu: "Help"

(*See* chapter: Open, Print, ***About*** CADMOULD® 3D-F RAPID, Manual)



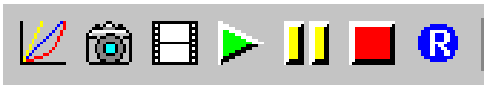
These buttons contain the commands: "Import STL", "Gates", "Material", "Process", "Description" and "Simulation". These correspond to the same commands: "Import STL", "Gates", "Material", "Process", "Description" and "Simulation **(Go)**" in the pull down menu: "File", “Edit” and "Simulation".

(*See* chapter: Import, Gates, Material, Process, Description, Simulation)



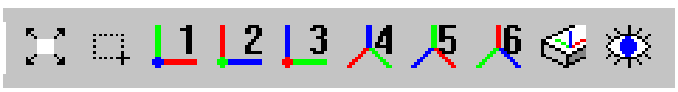
This button contain the command: "Thickness" in the pull down menu "Edit".

(See chapter: Thickness)



These buttons contain the commands: "View Results", “Save Window”, “Animation File”, "Play", "Pause", "Stop" and "Report". "View Results" and “Report” correspond to the commands: "Selection" and “Report” in the pull down menu: "Results", “Save Window” in the pull down menu: “File”.

(*See* chapters: Selection, Save Window, Animations Report)



The first button projects your part full size onto the screen. The second button launches the command: "Zoom".

(*see* chapter: Zoom)

The numbered buttons 1 to 6 contain 12 pre-defined views of the part. Each button contains two views of the part. The views can be chosen by clicking a button ones or twice. Different colors are assigned to each axis (x, y, z). The x-axis is red, the y-axis is green and the z-axis is blue. These functions give you a clear definition of the spatial position of the part.

The last two buttons contain the instructions: “Look vertically at...“ and "Save" in the menu "View".

(*see* chapter: Look vertically at..., Save)

12.2 Mouse Control + Keyboard

12.2.1 Combination of keys

You can select many instructions of CADMOULD® 3D-F by a combination of keys. Keep the "Alt" button pressed and press the underlined letters to call the command. If a combination of keys (“hot-keys”) is noted in the pull down menu behind the command, you can select the instruction directly without having to invoke the menu first.

Example:
"Zoom"
You find the command "Zoom" in the pull down menu: "View". Combination of keys: "Alt" + "v" + "z ",

Or

Combination of keys: "Ctrl" + "a"

12.2.2 Light

New position of the light
Keep the keys <Ctrl> and <Shift> pressed. Click the left mouse button, keep it pressed and define a new position of the light by mouse.
Press the keys <Ctrl> + <Shift>, in order to activate the standard lighting.

12.2.3 Rotation

F3-key:

(1) Switch to the command <Rotation> in the status bar by pressing the F3-key.

(2) The part can be turned with the arrow keys and <PgUp> and <PgDn> around the axes parallel to the screen edges or with the < x, y, z > keys around the axes of the coordinate system now.

a) **x-key**: the part turns counterclockwise around the x-axis

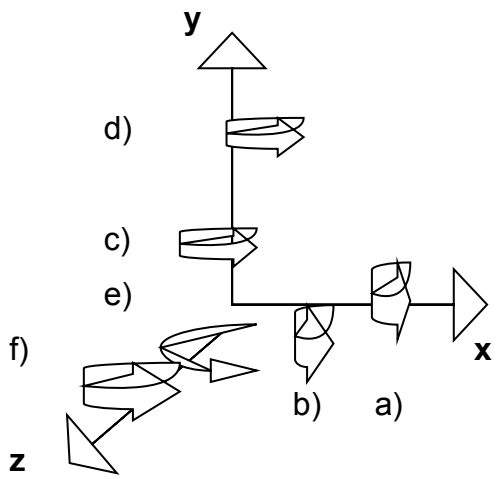
b) **X-key**: the part turns clockwise around the x-axis

c) **Y-key**: the part turns counterclockwise around the y-axis

d) **Y-key**: the part turns clockwise around the y-axis

e) **z-key**: the part turns counterclockwise around the z-axis

f) **Z-key**: the part turns clockwise around the z-axis



Mouse:

Keep the **left** mouse button pressed and move the pointer into the direction of rotation.

12.2.4 Zoom

F3-key:

(1) Switch to the command <Zoom> in the status bar by operating the F3-key.

(2) The part can be zoomed by the arrow keys <up> = zoom out, <down> = zoom in now.

Mouse:

Keep the **right** mouse button pressed and move the pointer up or down.

OR

Zoom in and out with the mouse wheel.

12.2.5 Pan

F3-key:

(1) Switch to the instruction <Pan> in the status bar by operating the F3-key.

(2) The part can now be shifted by the arrow keys in direction of the arrow or with the x, y, z keys as follows.

x-key: Along the x-axis in positive direction

X-key: Along the x-axis in negative direction

y-key: Along the y-axis in positive direction

Y-key: Along the y-axis in negative direction

z-key: Along the z-axis in positive direction

Z-key: Along the z-axis in negative direction

Mouse:

Keep the **middle** mouse button pressed and move the pointer into the direction, in which you want to move the part.

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The user is exclusive responsible for the application of the software excluding ***sim**con* kunststofftechnische Software GmbH of any adhesion. This applies in particular to demand on replacement of damages.

The information in the delivered database is given in good faith and they are meant for the simulation of the injection moulding process with CADMOULD® 3D-F. Nevertheless they are non binding references and contain no warranties or guaranties of certain properties of the materials of ***sim**con* or the producer of the material. The user takes sole responsibility for the use of the data and the database system under the exclusion of every liability of ***sim**con*. ***sim**con* expressly excludes any warranty or liability for damages or consequential damages for results calculated with information in this database.

Before decisions are made on basis of the material data administered by this program, the respective producer of the material must be contacted, in order to examine the topicality and correctness of the information in each case.

15. Appendix

STL (stereolithography):

Data format for 3D-CAD-Data for rapid prototyping. Closed description of the surface of 3D solids by means of triangular facets. A facet is described by its 3 corner points and its surface normal vector. Semi-standard for rapid prototyping. Abstraction of true surface information. Typical errors are: gaps, overlapping or intersection facets and mis-orientation of normal vectors.

Rapid prototyping:

Procedure for the quick production of prototypes, supported by access to 3D-CAD-Data.

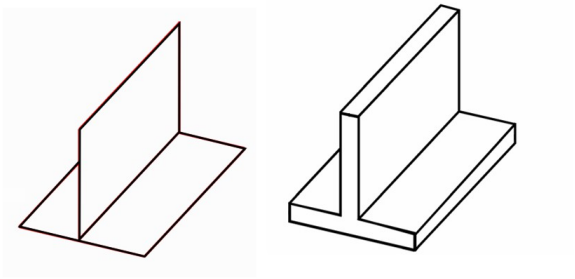
Technical Explanation of the CADMOULD® 3D-F Technology

Dr. Paul F. Filz, Dr. F. Karl Webelhaus

For the calculation of fluid flow within 3 dimensional objects like in cavities of injection moulds for plastics there are two classical Finite Element methods (Fig. 1):

- Midplane model
- Volume model

Midplane Model



The midplane model calculates the flow in the midplane of the geometry. The geometry is represented in a 3 dimensional way but without showing the wall thickness. The wall thickness is numerically assigned to the midplane elements of the geometry as a property.
The midplane model is usable for geometries where the thickness is small compared to the other dimensions. Most injection molded plastic parts are thin walled and fulfill this demand.

Fig. 1: Classical models

Plastic melts flow laminar, i.e. in layers without perpendicular flow, because of their high viscosity. Turbulent flow does not occur.[1] Temperature, shear rate and viscosity, among others, change strongly across the wall thickness. To describe this accurately the midplane model is divided into many layers across the wall thickness.

Advantages of the midplane model are:

- High resolution in areas with substantial changes e.g. of the temperature and the shear rate by dividing the wall thickness into many layers
- easy geometry changing for optimization e.g. flow leader definable independent of CAD in the Finite Element model
- fast calculation
- exact results

1 Reynolds no. normally << 1. Turbulent flow starts at Reynolds no. > 2100. Even in thin gates, areas of high shear rates, Reynolds no. < 20 /Lit. 1/

Disadvantages of the midplane model are:

- the midplane model mostly cannot be created completely automatically from the CAD geometry
- Creating the midplane model means time consuming interactive computer work for the user and needs certain experience /Lit 2/
- The user has to decide which are the flow or thickness directions at areas with large thickness
- Interpretation of the results is more difficult due to the geometrical abstraction (no representation of the wall thickness in the geometrical model)

Volume model

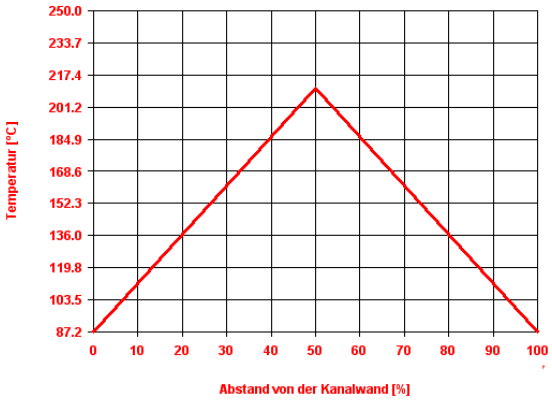
The volume model calculates the flow in all three spatial directions. Here the wall thickness is visible because it is part of the model. Layers are not used.

Advantages of the volume model are:

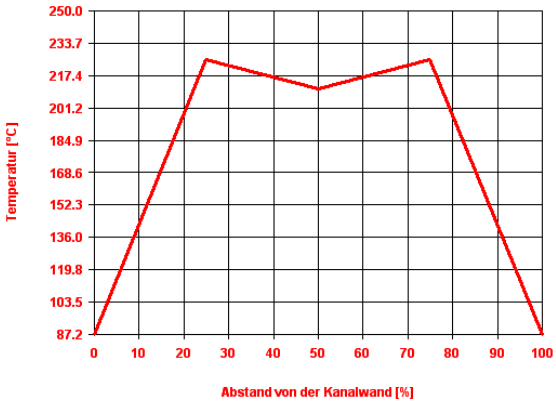
- All spatial directions are equal; the geometry must not be divided into flow or thickness directions by the user.
- By using simple Finite Elements the creation of the geometry can be performed automatically
- Realistic representation of the geometry

Disadvantages of the volume model are:

- Also simple changes in the geometry need tedious interactive work by the user e.g. changing of the design in the CAD system and redoing of the Finite Element mesh generation
- For reasonable accuracy a high number of Finite Elements also across the wall thickness is necessary
- Special user know-how for optimal mesh generation is necessary (e.g. accuracy vs. calculation time)
- Large numbers of elements lead to unacceptable long calculation times /Lit 3/.
- Too coarse discretisation in wall thickness direction leads to inaccurate results (Fig. 2)



3 volume elements across wall thickness



5 volume elements across wall thickness

Fig 2: Temperature distribution across wall thickness with coarse discretisation of the volume model

CADMOULD® 3D-F Model

This was the reason why ***sim**con* developed the patented 3D framework model (3D-F).

The 3D-F Finite Element model is especially adapted for plastic injection molding simulation. It connects the advantages of the two classical models without having their disadvantages.

As basis the 3D-F method uses the geometry description in stl format which was developed for Rapid Prototyping (stereolithography). The stl model is generated automatically by the CAD system. The described part volume is filled additionally by many „tubes“ in the inside, in which fluid flow occurs and by which mechanical forces e.g. for shrinkage and warpage calculation can be transferred. Thus the 3D framework is created, which extends in all three spatial dimensions (x, y, z) (Fig. 3).

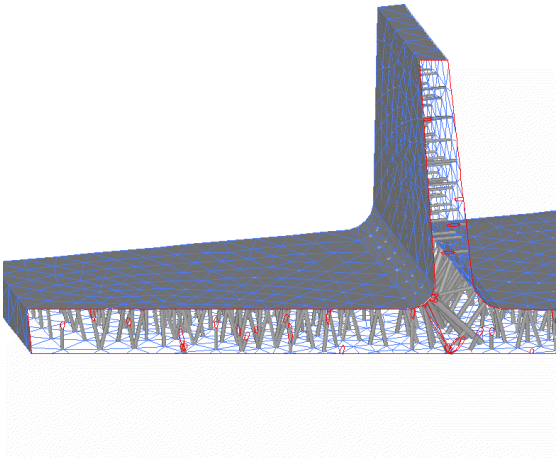


Fig. 3: CADMOULD® 3D-Framework geometry model[2]

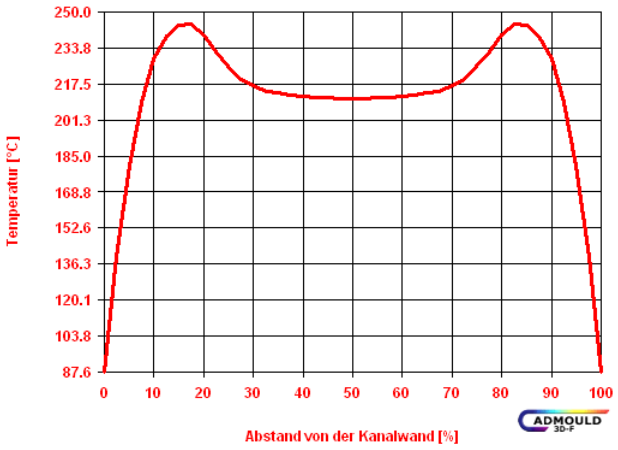


Fig 4: Accurate CADMOULD3D-F calculation with high resolution across the part thickness

2Tube diameters are represented smaller than in reality for better representation.

It allows very accurate resolution of the shear rates, temperatures, etc. varying across the wall thickness. (Fig. 4)

This is a necessary prerequisite for accurate calculation of the locally different, complex fluid flow conditions like pressure, velocity, the resulting clamping force and fiber orientations. This and an accurate thermal calculation are also preconditions for accurate determination of shrinkage and warpage.

To achieve the necessary high resolution, in the CADMOULD® 3D-F Model the part is discretized across the wall thickness in 25 sampling points in all areas.

Advantages of the CADMOULD® 3D-F model are:

- Automatic geometry creation
- High resolution in areas of substantial changes e.g. of temperature and shear rate across the wall thickness
- Volumetric part areas and areas with steps in wall thickness are represented and considered accurately
- easy geometry changing for optimization e.g. flow leader definable independent of CAD in the Finite Element model
- Realistic geometry representation
- The feedback of the optimized geometry shape (compensation of shrinkage and warpage) to the CAD system is possible.
- Fast calculation
- Exact results

Conclusion

In addition to save application, CADMOULD® 3D-F with its patented 3D framework model gives the industrial user exactly what he expects from a process simulation software:

- Easy, automatic model creation
- Fast calculation
- Exact results

Authors

Dr. Paul F. Filz is managing director of ***simcon*** kunststofftechnische Software GmbH

Dr. F. Karl Webelhaus is head of development of ***simcon*** kunststofftechnische Software GmbH.

Literature

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